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TECHNICAL DATA

TM 9-1710C

U.S. ARMY MILITARY HISTORY INSTITUTE
CARLISLE BARRACKS, PA 17013-5008

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

CHASSIS AND BODY FOR HALF-TRACK VEHICLES

SEPTEMBER 11, 1942

TECHNICAL DATA
PUBLICATIONS DIV

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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORDNANCE MAINTENANCE: CHASSIS AND BODY FOR HALF-TRACK VEHICLES

CHANGES No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *28 May 1953*

TM 9-1710C, 11 September 1942, is changed as follows:

27. Wheel Brakes

* * * * * * *

e. Maintenance and adjustments.

* * * * * * *

(9) *Service data.*

* * * * * * *

Brake drum

Regrinding limits 0.125 in.

* * * * * * *

[AG 300.7 (28 Apr 53)]

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TECHNICAL MANUAL
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WAR DEPARTMENT
Washington, September 11, 1942

ORDNANCE MAINTENANCE

CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Prepared under the direction of the
Chief of Ordnance

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ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section I

INTRODUCTION

	Paragraph
Purpose	1
Scope of information	2
References	3

1. PURPOSE.

This technical manual is published for the information and guidance of ordnance maintenance personnel and is the third of a series of three maintenance publications provided for the subject vehicles.

2. SCOPE OF INFORMATION.

a. Vehicle. Information concerning the service maintenance, technical inspection, and lubrication of the entire vehicle will be found in TM 9-710.

b. Chassis and Body. Information is included in this manual concerning the detailed description, operation, inspection and trouble diagnosis, disassembly, maintenance and repair, assembly, and test of major components of the chassis (exclusive of power train and power plant) and body, supplementing TM 9-710 prepared for the using arm.

c. Power Train. For maintenance information concerning the power train, refer to TM 9-1710.

d. Power Plant. For maintenance information concerning the power plant and its accessories, refer to TM 9-1711.

3. REFERENCES.

All pertinent standard nomenclature lists, technical manuals, and other publications having reference to the materiel described herein, are listed in section XIII.

Section II

SERVICE MAINTENANCE

	Paragraph
Objective	4
Scope	5
Allocation of repair jobs	6

4. OBJECTIVE.

There is a distinct difference between the missions of organizational maintenance and of service maintenance. Organizational maintenance by the using arms has for its prime objective the routine preventive maintenance care and adjustment of vehicles so that they will be in good operating condition at all times with a minimum loss of elapsed time for repairs. Service maintenance by light and heavy maintenance organizations of the Quartermaster Corps and Ordnance Department has for its prime objectives, supply, technical inspection and corrective action, and repairs beyond the capacity of the using arms—either by unit replacement, overhauling, rebuilding, reclaiming, manufacturing, or any other methods considered most suitable.

5. SCOPE.

The scope of maintenance and repairs by maintenance personnel is determined by the ease with which the project can be accomplished, the amount of time available, weather conditions, concealment, shelter, proximity to hostile fire, equipment, tools and parts available, and skill of the personnel. Since all of these factors are variable, no exact system or procedure can be prescribed or followed.

6. ALLOCATION OF REPAIR JOBS.

The operations herein augment those which may be performed by personnel of the using arms.

a. Front and Rear Axles.

(See TM 9-1710).

b. Body.

Body	Replace
Body plates and supports	Repair, replace, or rebuild
Seats	Repair or rebuild
Sheet metal	Repair, weld, or rebuild
Tops	Repair, weld, or rebuild
Upholstering	Repair or replace
Windshields	Repair
Windshield wipers	Repair or rebuild

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

c. Bogie.

Sprockets	Repair
Bogie wheels	Repair
Hubs	Repair
Track supporting roller assemblies	Repair
Axle tube suspension	Repair
Idlers	Repair
Axle tube suspension	Repair, weld, machine, and aline
Brackets, rear suspension	Repair, weld, machine, and aline
Track adjusting mechanism	Rebuild
Bogie components	Machine, weld, and aline

d. Brakes.

Brake cylinders	Repair and hone
Brake shoes	Reline
Brake vacuum booster	Adjust, repair, and rebuild

e. Cooling System.

Fan	Repair
Fan bearings	Replace
Radiator	Repair

f. Electrical Generating and Starting System.
(See TM 9-1711.)

g. Electrical Ignition System.
(See TM 9-1711.)

h. Electrical Lighting System and Accessories.

Battery	Repair
Heater	Repair
Horn	Repair
Lights	Repair

i. Engine.
(See TM 9-1711.)

j. Frame.

Frame	Repair or straighten
Pintle	Repair
Roller	Replace or repair

k. Fuel System.

Fuel gage components	Repair
Fuel tanks	Repair

SERVICE MAINTENANCE

l. Instruments.

Cluster	Repair
Meters	Repair

m. Propeller Shafts.

(See TM 9-1710).

n. Springs and Shock Absorbers.

Absorbers	Repair
Springs	Repair or rebuild

o. Steering Gear.

Drag link	Repair
Steering gear	Repair or rebuild

p. Transmission—Transfer Case.

(See TM 9-1710).

q. Wheels.

Line casings and tube	Repair
Wheels	Repair, weld, machine, and aline

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section III

TECHNICAL INSPECTION

	Paragraph
Description	7
Inspection form	8
Practical application	9

7. DESCRIPTION.

Technical inspections are a follow-up and check on organizational maintenance inspections and other maintenance functions, and determine whether the vehicle should be continued in service or withdrawn from operation for overhaul. These inspections are covered in AR 850-15.

8. INSPECTION FORM.

War Department Quartermaster Corps Form No. 260, "Technical Inspection Report of Motor Vehicles," is the standard and official form for recording the inspection of all motor vehicles, including combat vehicles of the Ordnance Department. The extent to which use is made of this form or modifications thereof depends entirely on the technical ability of available personnel, the time factor, and the test and shop equipment available.

9. PRACTICAL APPLICATION.

a. External Inspection of Body and Frame Components.

(1) BUMPERS. Examine for straightness; use wrench to test channel bolts for tightness; inspect brackets for breaks.

(2) TOW HOOKS. Inspect for straightness and fractures; use wrench to test mounting bolts for tightness.

(3) FRONT ROLLER. Check freedom of rotation; inspect springs and supporting brackets for breaks.

(4) RADIATOR SHUTTERS. Inspect for breaks in armor plate and loose screws; open right door and operate louver lever to check opening and closing of shutters.

(5) RADIATOR. Examine underneath for leaks; inspect front of core for plugged air passages.

(6) HEADLIGHT GUARDS. Shake to determine looseness; inspect for breaks and fractures.

(7) TIRES. Inspect for serviceability; examine for indications of improper inflation or use, cuts, blisters, breaks, uneven wear, etc.; record defects for each tire.

(8) HOOD. Inspect for breaks in armor plate and loose screws; exam-

TECHNICAL INSPECTION

ine fasteners and hinges; inspect lacings for breaks; open and shut to check for fit.

(9) RUNNING BOARDS AND FENDERS. Examine for cracks and dents; shake up and down to test for looseness; use wrench to test mounting bolts for tightness; inspect support brackets for breaks.

(10) DOORS. Open and close to test for fit; shake up and down while open to test for loose hinges; turn handles and check locks and latches; inspect for loose and missing screws; check operation and securement of observation slot covers.

(11) GLASS. Inspect windshields for cracks and fit; check mounting details; examine for leaks and defective seals.

(12) BODY. Inspect for breaks in armor plate and loose screws; examine under side for bent or broken frame, angles, battens and welds; check for loosened floor plates, and check securement of grab handles.

(13) PAINT. Inspect for chipped paint, rust spots, scratches, bright metal, gloss, peelings, and cracks.

(14) TOP AND CURTAINS. Inspect for breaks in material and indications of leaks; examine straps and keepers.

(15) PINTLE. Inspect towing device for securement; examine latch effectiveness; check operation; test tightness of pintle hook retaining nut with wrench.

(16) LIGHTS. Inspect for broken glass and reflectors; check wire connections; test tightness of head lamp mounting stud nuts with wrench; check securement of tail lamps, turn on lights, and check all bulbs for different positions of light switch; be sure to turn off lights.

(17) AMMUNITION RACKS. Check covers; inspect shelves.

(18) BATTERY AND COMPARTMENT. Remove top housing plate; check level and specific gravity of electrolyte in each cell; check voltage drop across cells with tong tester; examine terminals for looseness and corrosion; inspect cables and ground straps; check vents and tighten plugs.

b. External Inspection of Chassis Components.

(1) WHEELS. Check all wheel nuts with wrench; check lubrication of bearings.

(2) SPRINGS. Inspect for broken leaves, loose clips, worn or damaged shackles, and misalinement; check shackle lubrication; test all shackle bolts with wrench; use pry bar to check flexing of springs.

(3) SHOCK ABSORBERS. Check fluid level; examine linkage; inspect securement and lubrication.

(4) FRAME. Inspect frame side rails and cross members for distortion and fractures; examine front end for evidence of stress due to overhang of loads; inspect all rivets and especially those for the roller brackets, spring brackets, engine supports, and steering gear bracket; examine battery tray support rivets for corrosion.

(5) STEERING GEAR HOUSING. Test all nuts with wrench. While some-

one turns steering wheel, observe housing for leaks, shimmy or looseness. Check lubrication.

(6) STEERING GEAR LINKAGE. Inspect drag link for straightness; check lubrication and presence of boots; test all nuts with wrench.

(7) BRAKE LINKAGE. Check all clevis pins for lubrication, presence of cotter pins, and looseness; inspect rods for straightness, cracks, rust and corrosion.

(8) BRAKE LINES. Check for leaks, breaks, and loose connections; examine flexible tubing for cracks.

(9) VACUUM BOOSTER. Examine linkage and securement.

(10) FUEL LINES. Check for leaks, breaks, and loose connections.

c. Engine Compartment (Engine Stopped).

(1) RADIATOR. Examine for leaks, rust, corrosion, and clear air passages; shake to observe if it is loose in the frame; tighten all stud nuts with wrench; check clearance of fan blades; check vent; check for presence of radiator cap and proper water level; test antifreeze solution with suitable hydrometer.

(2) FAN. Inspect blades for breaks, looseness, and proper pitch; shake to test for looseness and worn bearings.

(3) FAN BELT. Inspect for matching of belts and play; examine for fraying, tears, and presence of grease or oil; check alinement of pulleys.

(4) SHROUD. Inspect for fit and securement; check clearance of fan blades; tighten screws.

d. Interior Inspection (Engine Started).

(1) SWITCHES. Check operation; examine securement; inspect wiring.

(2) METERS. Check operation; examine securement; inspect connections.

(3) GAGES. Check operation; examine securement; inspect connections; feel tachometer and speedometer cables for excessive heat and vibration.

(4) WINDSHIELD WIPERS. Check operation.

(5) PANEL LIGHTS. Check operation.

(6) HORN. Check operation.

(7) FIRE EXTINGUISHER. Check securement; inspect for full charge.

(8) CHOKE AND VENTILATOR CONTROLS. Check free operation and note a movement of ventilator slides; have an assistant note movement of choke valve in carburetor.

(9) ACCELERATOR. Check for proper alinement and operation.

(10) PEDALS. Check for proper operation.

(11) BRAKE FLUID. Remove floor cover in front of driver's seat and inspect master cylinder; examine fluid; check securement and connections.

(12) LOUVER CONTROL LEVER. Operate lever to check movement and position of radiator shutters.

(13) SEATS. Inspect for breaks, damaged brackets, and upholstery.

(14) GUN RAIL PADS. Inspect.

(15) GUN RAIL. Inspect for breaks, cracks and rust; examine securement around entire circumference, and operate gun carriage around each corner to check alinement.

(16) TOP BOWS. Inspect bows for breaks and securement.

e. Engine Compartment (Engine Running).

(1) FUEL LEAKS. Inspect fuel lines for leaks.

(2) OIL LEAKS. Inspect under vehicle for evidence of oil drippings.

(3) WATER LEAKS. Inspect hose connections to radiator, water pump, and heater for leaks; feel hose for condition of fabric and flow of fluid; examine radiator for leaks.

(4) WIRING. Inspect wires around engine and along frame; tug on wires to check for loose connections evidenced by sparking; examine terminal board connections.

(5) VOLTAGE REGULATOR. Disconnect lead to battery and use voltmeter to check for correct cut-out and open-circuit voltages.

f. Road Test.

(1) BODY NOISES. Listen for any unusual body noises, squeaks, or rattles, and identify location and cause.

(2) DRIVE SHAFT BRAKE. Test by pulling on hand brake lever and gently engaging clutch to stall the engine; note any unusual noises or signs of loose parts; do not attempt to stop rolling vehicle with this brake.

(3) SERVICE BRAKES. Test by applying pressure to foot pedal and observing results, including tendency of vehicle to swerve or stall.

(4) SPEEDOMETER AND TACHOMETER CABLES. Observe instruments to note registering. Feel cable; if hot, internal friction is developing because of improper adjustment or lack of lubricant; if a slight click or thump is heard, the cable should be removed and inspected for distortion, incorrect length or diameter, and breaks.

(5) STEERING MECHANISM. Note whether steering wheel has a tendency to jerk; such action indicates a looseness in the steering mechanism from the front axle to the wheel, or an error in steering geometry. Note any tendency on the part of the vehicle to wander or drive to the right or left, indicating improper adjustment or an error in steering gear geometry. If a thump or knocking is felt in the steering wheel, a part is probably loose in the steering gear worm.

g. Inspection of Other Components. See TM 9-1710, Power Train, and TM 9-1711, White, 160AX Engine.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section IV

BODY AND SHEET METAL

	Paragraph
Body	10
Sheet metal	11
Windshield wipers	12

10. BODY (figs. 1 through 11).

All half-track vehicle bodies are made of ¼-inch thick armor plate with the exception of the windshield plate and the door shield sliding plates, which are ½ inch thick. The plates are bolted to the body framework with oval-head screws and self-locking nuts. The entire body assembly is bolted to the chassis frame assembly. The floor plates are made of checkered aluminum or steel and are either bolted to the body framework or hinged wherever they serve as compartment covers. The fundamental differences in the bodies of the vehicles are explained in Section II, TM 9-710.

a. Disassembly.

(1) The side doors, door shields, windshield plate, side and top hood plates, the rear door on the Carrier M3, and the ammunition rack doors on the Car M2 are all hinged and are removed by removing the oval-head screws or bolts and self-locking nuts with which the hinges are bolted to these units. An air wrench is usually necessary to remove the self-locking nuts.

(2) The hinged floor plates are removed by removing the cap screws and nuts holding the plates to the hinges.

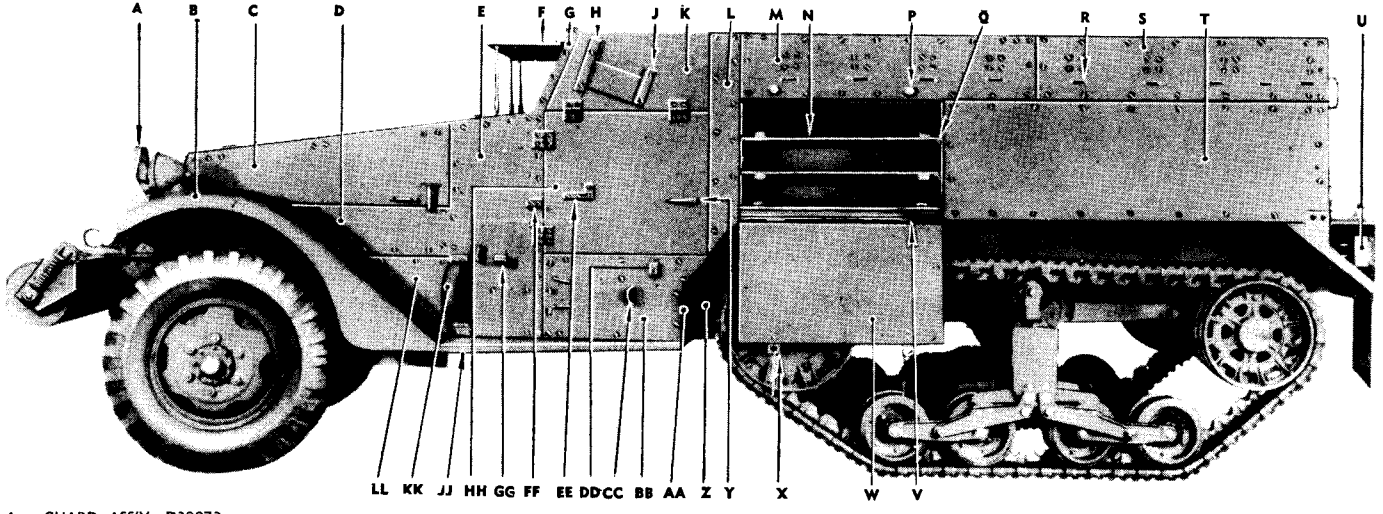
(3) The remainder of the body plates are disassembled by removing the holding screws and nuts.

b. Maintenance.

(1) All damaged bolts and screws should be replaced as soon as it is practicable.

(2) Bent armor plates should be removed, and straightened by cold bending. Do not attempt to use heat for straightening, as this will destroy the hardness of the plates and their ability to resist gunfire.

(3) Plates which are pierced by shells should be replaced with new plates. If this is not possible, temporary repairs can be made by bolting a section of plate over the shell hole. Plates can be repaired by welding according to procedures outlined in TB-1852-1.



A — GUARD, ASS'Y - D38073
B — FENDER, ASS'Y - D48114
C — ARMORPLATE (H-11) - B185131
D — ARMORPLATE (H-9) - B185129
E — ARMORPLATE (H-21) - B185141
F — ARMORPLATE (H-25) - A215594
G — ARMORPLATE (H-23) - B185143
H — BRACKET - A215424
J — BRACKET - A215423

K — ARMORPLATE (H-37) - B185157
L — ARMORPLATE (H-39) - B185159
M — ARMORPLATE (H-43) - B185163
N — SHELF - B185196
P — {STUD - A215392 / BUMPER - A215427}
Q — ANGLE - B185203
R — LOOP - A215426
S — ARMORPLATE (H-45) - B185165

T — ARMORPLATE (H-49) - C86037
U — BRACKET - B185380
V — HINGE, ASS'Y - A215376
W — DOOR - B185167
X — PLATE - A215437
Y — HANDLE - A215385
Z — ARMORPLATE (H-41) - B185161
AA — PLATE - B185345
BB — ARMORPLATE (H-27) - B185147

CC — BRACKET - A19309
DD — BRACKET - HB8C
EE — KEEPER, ASS'Y - A215429
FF — STOP - A215472
GG — BRACKET - B151233
HH — ARMORPLATE (H-35) - B185155
JJ — BOARD, ASS'Y - B185234
KK — BRACKET - HB8M
LL — ARMORPLATE (H-17) - B185137

RA PD 3746

Figure 1—Body, Left Side View, Car, Half-Track, M2

A — WIPER, ASS'Y - B185193

B — {BLADE - B185472
ARM - B185473

C — HOLDER, ASS'Y - B185259

D — ARMORPLATE (H-34) - B185154

E — HANDLE - A215386

F — LOCK, ASS'Y - C86053

G — ARMORPLATE (H-32) - B185152

H — ARMORPLATE (H-33) - B185153

J — BATTEN - B185294

K — STRIKE, W/BATTEN - B185329

L — PLATE - B185301

M — {ARMORPLATE (H-31) (REAR) - B185151
ARMORPLATE (H-29) (FRONT) - B185149

N — BRACKET - HB16E

P — ARMORPLATE (H-28) - B185148

Q — PLATE - B185344

R — ARMORPLATE (H-42) - B185162

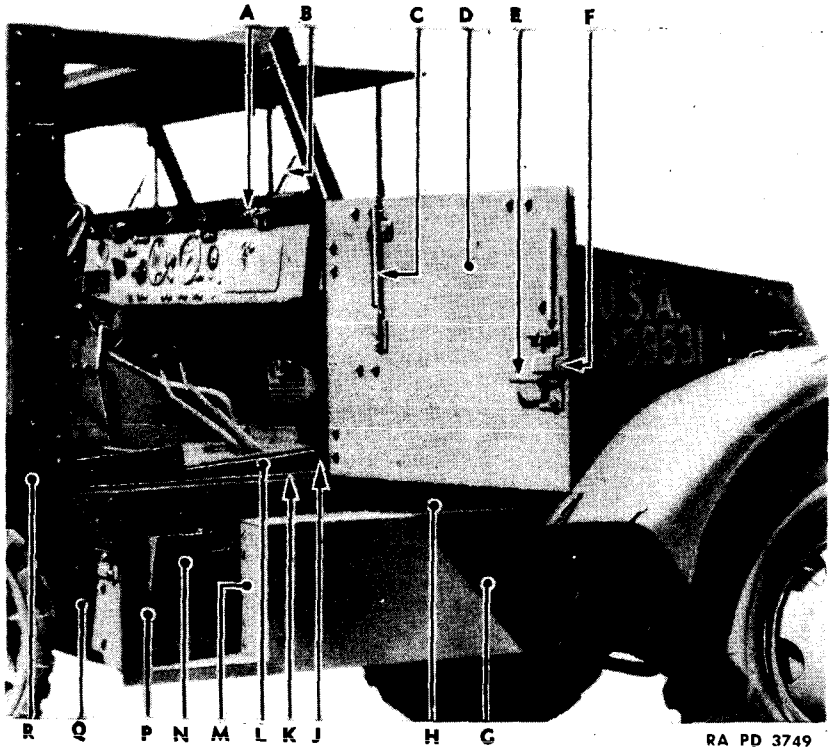
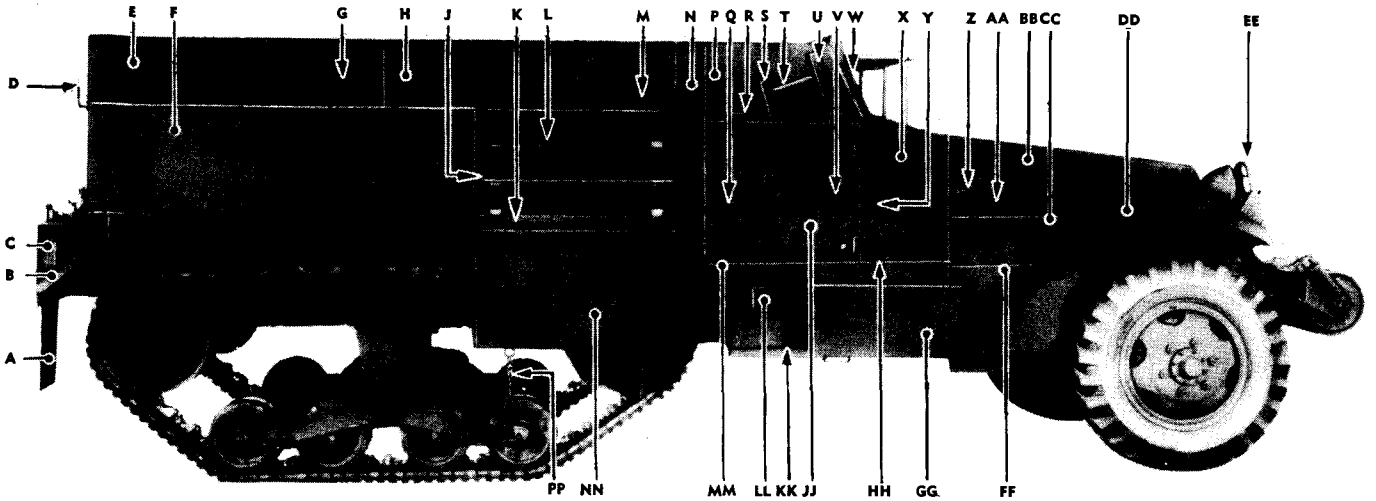


Figure 2—Body, Right Front View, Car, Half-Track, M2

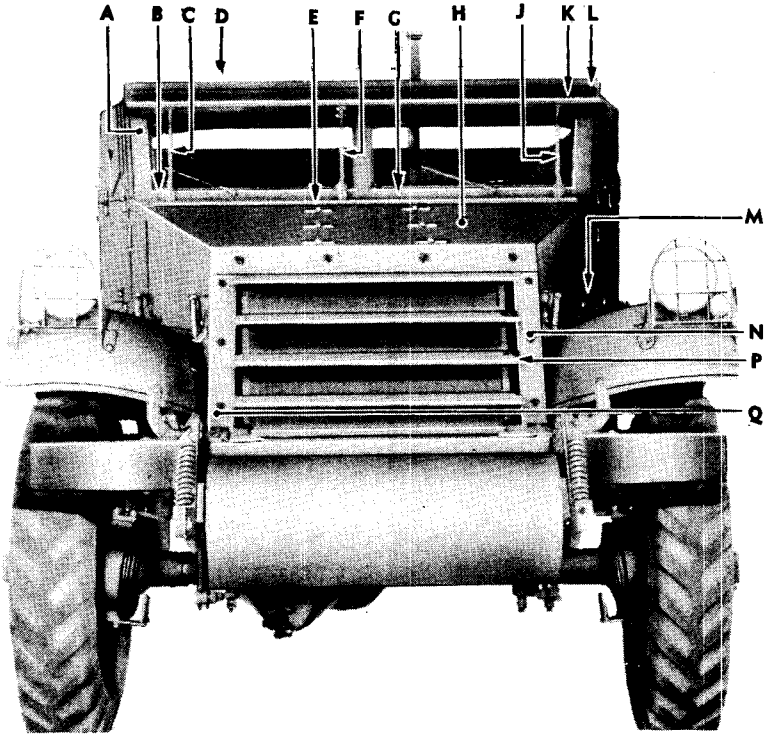


A — FLAP - B185423
B — BUMPER, ASS'Y - B185274
C — BRACKET - B185380
D — HANDLE - A215384
E — ARMORPLATE (H-46) - B185166
F — ARMORPLATE (H-48) - C86036
G — LOOP - A215426
H — ARMORPLATE (H-44) - B185164
J — ANGLE - B185202
K — HINGE, ASS'Y - A215376
L — SHELF - B185196
M — STUD - A215392; BUMPER - A215427
N — ARMORPLATE (H-40) - B185160
P — ARMORPLATE (H-36) - B185156
Q — HANDLE - A215386
R — HINGE - A215373
S — BRACKET - A215422
T — ARMORPLATE (H-38) - B185162
U — BRACKET - A215421
V — KEEPER, ASS'Y - A215428
W — ARMORPLATE (H-22) - B185142
X — ARMORPLATE (H-20) - B185140
Y — STOP - A215471
Z — CATCH - A215371
AA — HANDLE - A215425
BB — ARMORPLATE (H-10) - B185130
CC — ARMORPLATE (H-8) - B185128
DD — FENDER, ASS'Y - D48115
EE — GUARD, ASS'Y - D48122
FF — ARMORPLATE (H-18) - B185138
GG — ARMORPLATE (H-32) - B185152
HH — BRACKET - A138945
JJ — ARMORPLATE (H-34) - B185154
KK — BOARD, ASS'Y - B185231
LL — BRACKET - HB16E
MM — ARMORPLATE (H-30) - B185150
NN — ARMORPLATE (H-47) - B185167
PP — CHAIN, W/PIN - A215528

RA PD 3747

Figure 3—Body, Right Side View, Car, Half-Track, M2

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

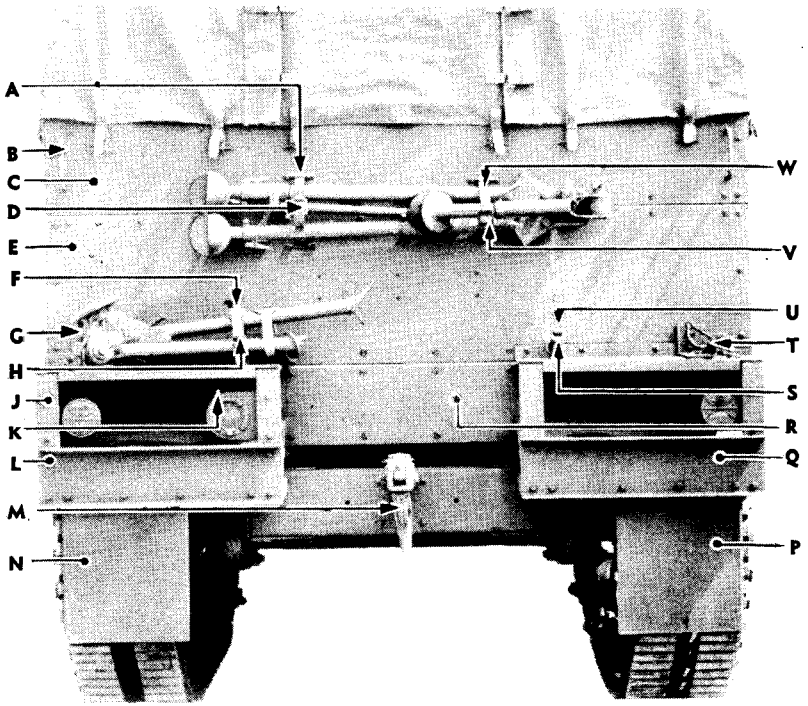


A — FRAME, ASS'Y - D48419
B — ARMORPLATE (H-19) - B185139
C — ROD, ASS'Y - B185204
D — ARMORPLATE (H-24) - B185144
E — HINGE, ASS'Y - A215373
F — ROD, ASS'Y - B185206
G — BAR - B185425
H — ARMORPLATE (H-1) - B185121
J — ROD, ASS'Y - B185205
K — HINGE, ASS'Y - A215375
L — PLATE - C86081
M — BRACKET - A215372
N — ARMORPLATE (H-3) - B185123
P — ARMORPLATE (H-4) - B185124
Q — ARMORPLATE (H-2) - B185122

RA PD 3750

Figure 4—Body, Front View, Car, Half-Track, M2

BODY AND SHEET METAL



A — STRAP, ASS'Y - A165663
B — HANDLE - A215384
C — ARMORPLATE - (H-50) - C86038
D — STRAP, ASS'Y - A165660
E — ARMORPLATE - (H-51) - C86039
F — STRAP, ASS'Y - B158640
G — BRACKET, ASS'Y - C69111
H — CLAMP, ASS'Y - C69074
J — BUMPER, ASS'Y - B185275
K — BRACKET - B185422
L — BUMPER - B185278
M — PINTLE, ASS'Y - A186785
N — FLAP - B185423
P — FLAP - B185423
Q — BUMPER - B185277
R — ARMORPLATE - (H-52) - B185168
S — CLAMP, ASS'Y - C69075
T — BRACKET, ASS'Y - C69112
U — STRAP, ASS'Y - B158641
V — STRAP, ASS'Y - A165672
W — STRAP, ASS'Y - A165666

RA PD 54068

Figure 5—Body, Rear View, Car, Half-Track, M2

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

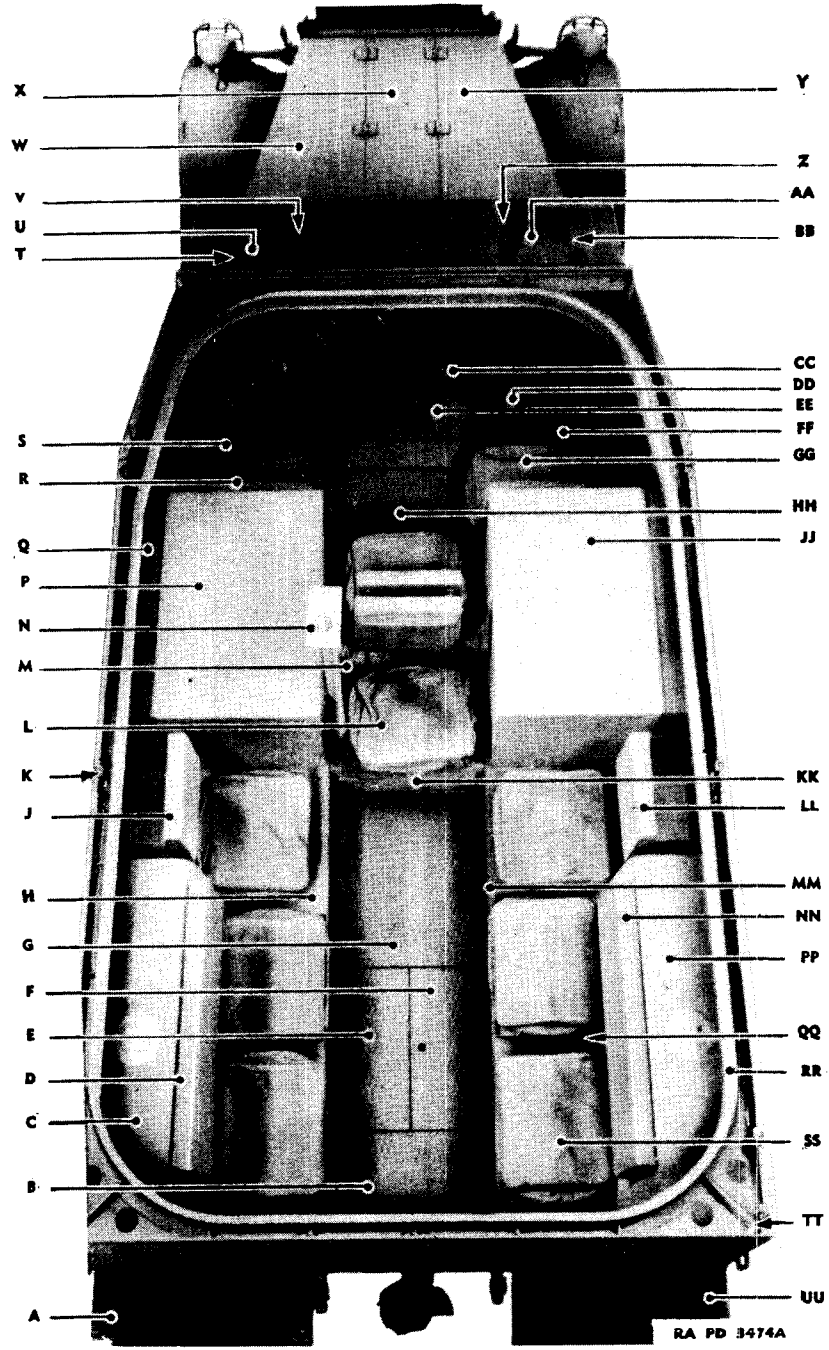


Figure 6A—Body, Plan View, Car, Half-Track, M2

BODY AND SHEET METAL

A — PLATE, ASS'Y - B185250

B — PLATE - B185255

C — COVER, ASS'Y - C86058

D — PAD - B185189

E — PLATE - B185226

F — PLATE - B185237

G — PLATE - B185225

H — LID, ASS'Y - C86066

J — PAD - B185188

K — BRACKET - D38093B

L — SEAT - C86048

M — PLATE - B185254

N — MAST, ASS'Y - B185358

P — BOX - D48415

Q — HINGE, ASS'Y - B185195

R — SEAT - C86046

S — PLATE - B185457

T — BRACKET - A215420

U — ARMORPLATE (H-26) - B185146

V — BRACKET - A215419

W — ARMORPLATE (H-13) - B185133

X — ARMORPLATE (H-14) - B185134

Y — ARMORPLATE (H-12) - B185132

Z — BRACKET - A215420

AA — ARMORPLATE (H-26) - B185146

BB — BRACKET - A215419

CC — PLATE, ASS'Y - B185462

DD — PLATE - B185247

EE — PLATE, ASS'Y - B185243

FF — PLATE - B185246

GG — SEAT - C86047

HH — PLATE, ASS'Y - B185240

JJ — BOX - D48414

KK — COMPARTMENT, ASS'Y - B185335
DOOR, ASS'Y - B185279
HINGE - A215530
BOLT - A215554

LL — PAD - B185188

MM — LID, ASS'Y - C86065

NN — PAD - B185189

PP — COVER, ASS'Y - C86057

QQ — HINGE - STANLEY NO. 808, FLAT BACK

RR — TRACK, ASS'Y - D48411

SS — CUSHION - C86050

TT — ANGLE - B185372

UU — PLATE, ASS'Y - B185249

RA PD 3474C

Figure 6B—Body, Plan View Nomenclature, Car, Half-Track, M2

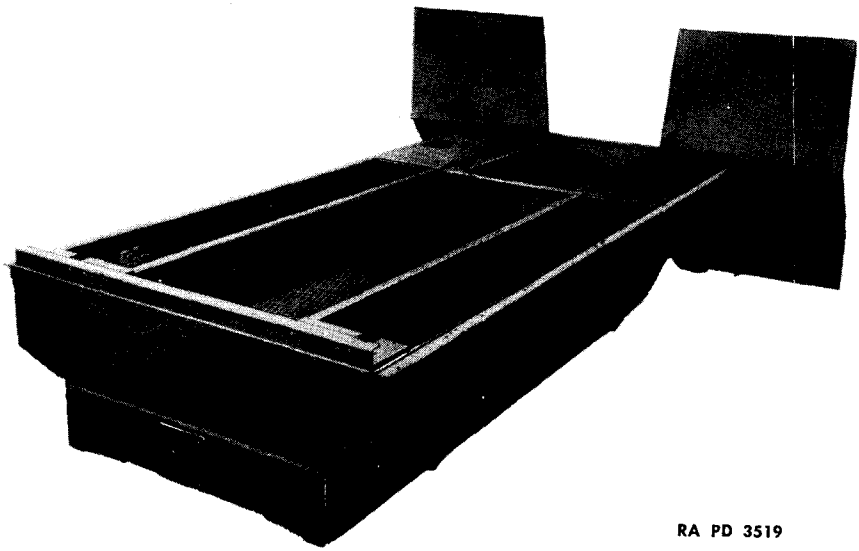


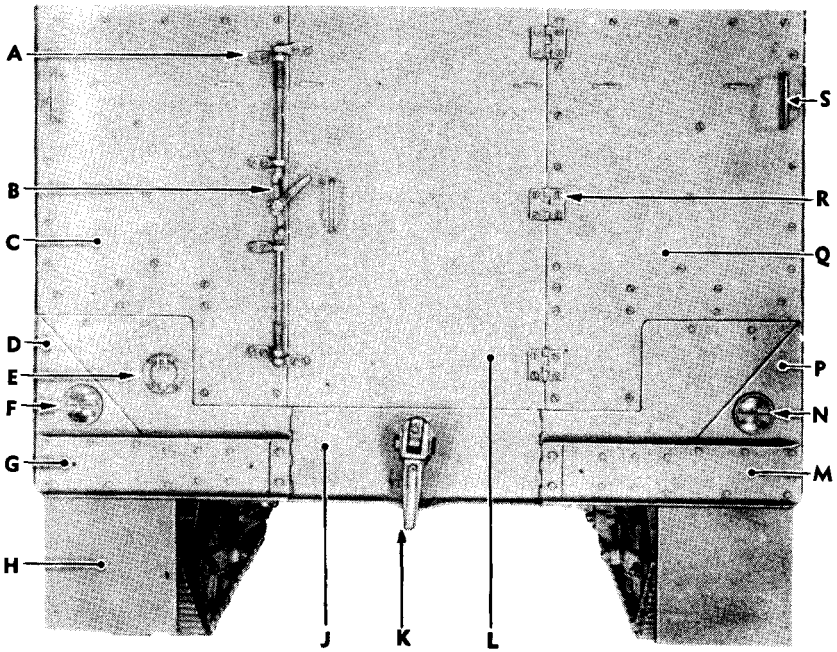
Figure 7—Body, Rear Floor Frame Assembly, Car, Half-Track, M2

(4) Replace damaged door lock springs and any other worn or damaged lock parts (fig. 12).

11. SHEET METAL.

a. Fenders.

(1) DESCRIPTION (fig. 13). The front wheel fenders are made of pressed steel. The outside edges are turned over to form a bead for reinforcing purposes and to prevent tearing. Each fender has two supports which are welded to the fender at their outer edges. The front support is bolted to the frame, and the rear support is bolted to the engine rear side armor plate. The fenders are also bolted to the body, engine side plates, and running boards. The head lamps and brush guards are bolted to the top front of the fenders. The head lamp and blackout marker lamp wires are pulled through grommets located in the fenders. Four strap fasteners are attached to each fender, and the straps which hold the canvas top bag are run through these fasteners.



A — BRACKET - A215518
B — LOCK, ASS'Y - E3857
C — ARMORPLATE (H-65) - C86044
D — PLATE (L.H.) - B185353
E — SOCKET, ASS'Y - C85565
F — TAIL LAMP, ASS'Y (L.H.) - C85533; OR C85787
G — CHANNEL - B185324
H — FLAP - B185423
J — BULKHEAD - C86069
K — PINTLE, ASS'Y - A186785
L — ARMORPLATE (H-67) - B185177
M — CHANNEL - B185323
N — TAIL LAMP, ASS'Y (R.H.) - C85532; OR C85786
P — PLATE (R.H.) - B185352
Q — ARMORPLATE (H-66) - C86045
R — HINGE - A215373
S — HANDLE - A215384

RA PD 54069

Figure 8—Body, Rear View, Carrier, Personnel, Half-Track, M3

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

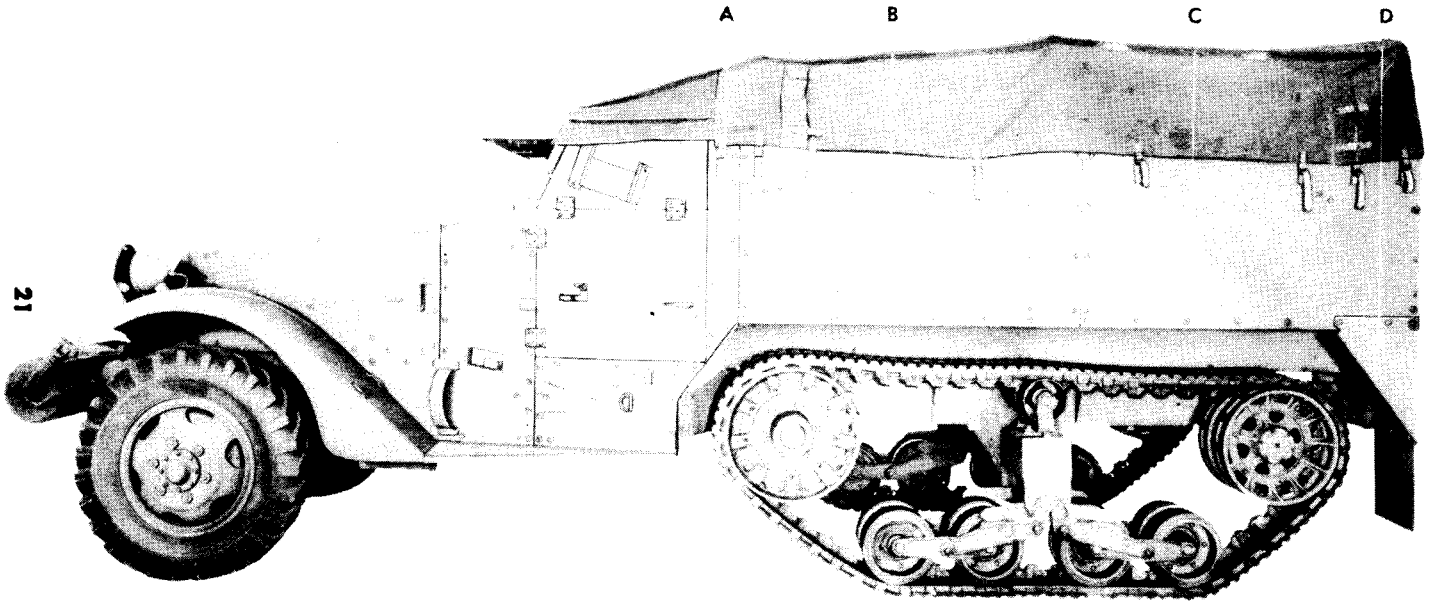
A — GUSSET - B185450

B — ARMORPLATE (H-64) - C86043

C — ARMORPLATE (H-62) - C86041

D — ARMORPLATE (H-40) - B185160

Figure 9—Body, Right Side View, Carrier, Personnel, Half-Track, M3



A — ARMORPLATE (H-39) - B185159

B — ARMORPLATE (H-61) - C86040

C — ARMORPLATE (H-63) - C86042

D — GUSSET - B185451

RA PD 3751

Figure 10—Body, Left Side View, Carrier, Personnel, Half-Track, M3

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

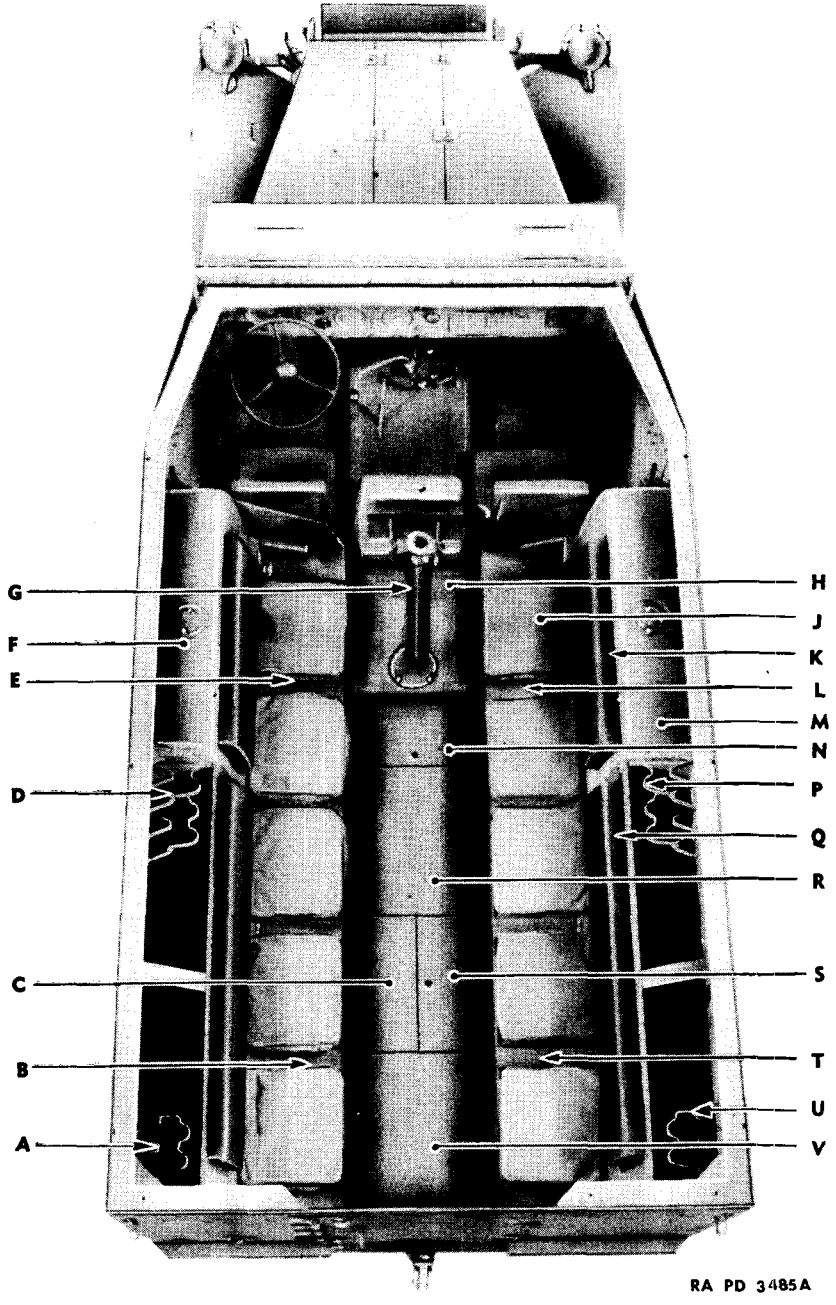


Figure 11A—Body, Plan View, Carrier, Personnel, Half-Track, M3

BODY AND SHEET METAL

A — SCABBARD - B185433

B — LID - ASS'Y - C86077
HINGE - A215503

C — PLATE, ASS'Y (L.H.) - B185226

D — SCABBARD - B185427

E — LID, ASS'Y - C86075
HINGE - A215503

F — COVER, ASS'Y - C86062

G — PEDESTAL - D42988

H — PLATE, ASS'Y - B185256

J — CUSHION - C86050

K — SEAT - B185189

L — LID, ASS'Y - C86074
HINGE - A215503

M — COVER, ASS'Y - C86061

N — PLATE, ASS'Y - B185248

P — SCABBARD - B185427

Q — SEAT - B185190

R — PLATE, ASS'Y - B185568

S — PLATE, ASS'Y - (R.H.) - B185237

T — LID, ASS'Y - C86076
HINGE - A215503

U — SCABBARD - B185432

V — PLATE, ASS'Y - B185569 RA PD 3485B

gure 11B—Body, Plan View Nomenclature, Carrier, Personnel, Half-Track, M3

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

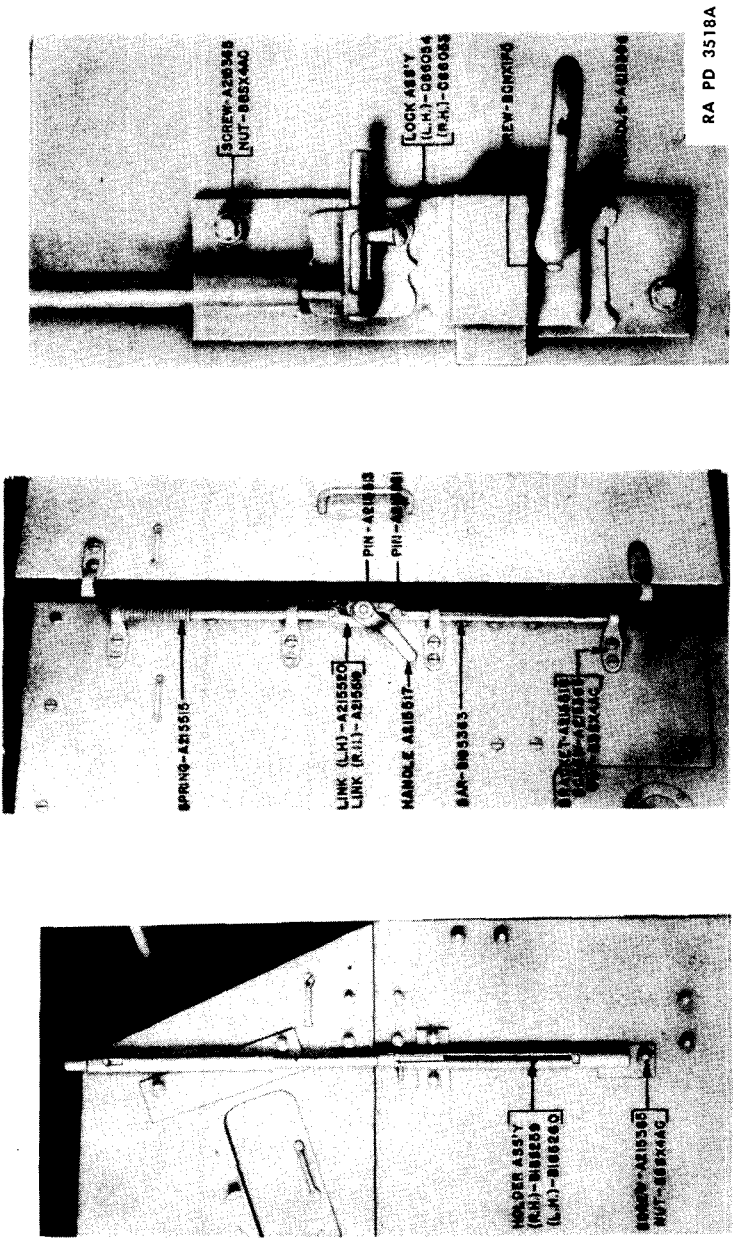


Figure 12—Body Handles and Locks—Installed

BODY AND SHEET METAL

(2) DISASSEMBLY.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{5}{16}$-in.
Wrench, socket, $\frac{7}{16}$-in.
Wrench, socket, ½-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, ⅝-in.

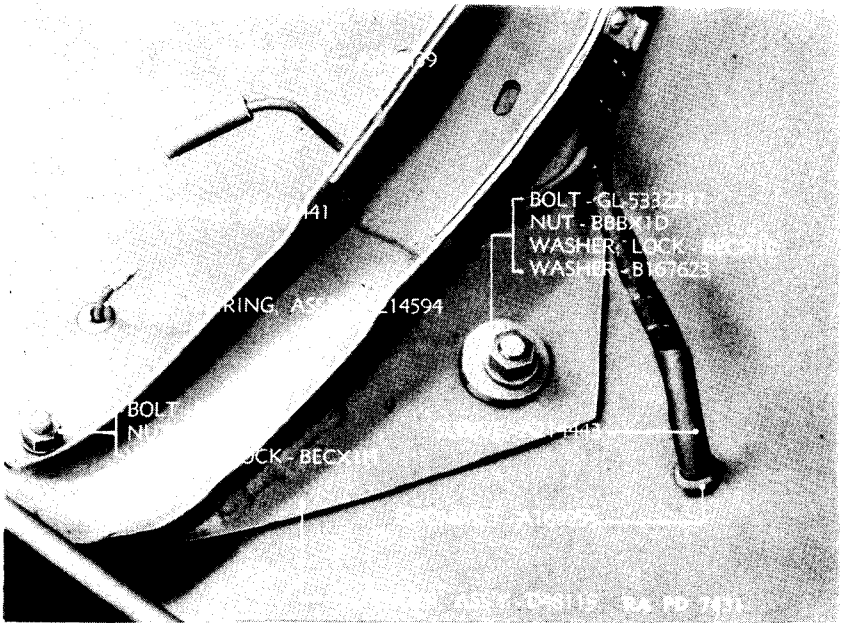


Figure 13—Front Fender—Bottom View

(a) Remove Brush Guard.

Wrench, open-end, ½-in.
Wrench, socket, ½-in.

Disconnect blackout marker lamp wire underneath fender. Remove four bolts, nuts, and lock washers holding brush guard assembly to fender.

(b) Remove Head Lamp.

Wrench, socket, ⅝-in.

Disconnect head lamp wire at rear of lamp. Remove nut and lock washer holding lamp to fender.

(c) Remove Strap Fasteners.

Wrench, socket, $\frac{5}{16}$-in.

Remove nuts, lock washers, and screws holding strap fasteners to fenders.

(d) Remove Fenders.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{7}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.

Remove two nuts, lock washers, and bolts holding each front fender iron to frame; remove two nuts, lock washers, and bolts holding fender rear brace to armor plate; remove nine nuts, lock washers, and bolts holding fender to armor plate; and remove three nuts, lock washers, and bolts holding rear of fender to running board support, and lift off fender assembly.

(3) MAINTENANCE. No maintenance is required on the fenders unless they are damaged in an accident or by shell fire.

(a) Bent or crushed fenders can be repaired by pulling and hammering them into shape. See Section IV, TM 10-450 for more detailed information.

(b) Torn or pierced fenders can be straightened by hammering, and can then be welded.

(4) REASSEMBLY.

Screwdriver
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{5}{16}$-in.
Wrench, socket, $\frac{7}{16}$-in.
Wrench, socket, ½-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, ⅝-in.

(a) Replace Fender.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{7}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.

Set fender in position and replace bolts, lock washers, and nuts holding fenders to frame, armor plate, and running board support.

(b) Attach Strap Fasteners.

Screwdriver
Wrench, socket, $\frac{5}{16}$-in.

Replace screws, lock washers, and nuts.

(c) Replace Head Lamps.

Wrench, socket, 5/8-in.

Set lamp assembly into fender, replacing holding nut and lock washer. Reconnect wire at rear of lamp.

(d) Replace Brush Guards.

Wrench, open-end, 1/2-in. Wrench, socket, 1/2-in.

Attach brush guard to fender with bolts, lock washers and nuts. Reconnect blackout marker lamp wire under fender.

b. Instrument Panel. The instrument panel ordinarily requires no maintenance unless it is damaged in combat. When this occurs, the panel can be removed as an assembly in the following manner: Disconnect instrument wires and tubing, controls, windshield wiper hoses, steering tube bracket, and instrument shielding box. Remove holding bolts, nuts, and lock washers, and pull out assembly. Mark wires and controls to facilitate reassembly.

12. WINDSHIELD WIPERS.

a. Description (fig. 14). The windshield wipers are of the vacuum type, and are mounted on the left- and right-hand sides of the windshield frame over the instrument panel.

(1) CONSTRUCTION (fig. 15.) The body and cover of the wiper are aluminum die castings. The cover contains the vacuum and atmospheric pressure inlet and exhaust ports and channels, and also the vacuum tube fitting which is connected to the vacuum side of the fuel and vacuum pump by a flexible hose and pipe assembly. The cover is bolted to the body with sealing gaskets between them. The starting control is a flat plate with slotted holes. It seats on the motor cover, over the exhaust ports, and is held in place by a cover and flat springs. The body encloses the paddle and supports the paddle shafts. The paddle consists of two plates which are riveted together and carry the sealing rubber elements between them. The sleeve, for attaching the assembly to the windshield, fits over one shaft which also carries the wiper arm and blade assembly. The opposite shaft carries the valve and valve kicker. The kicker yoke sets into a slot in the top of the kicker and is held by a spring which is attached to a retainer at its opposite end. The entire valve mechanism is enclosed by a cap which snaps onto the body casting.

(2) OPERATION.

(a) The vacuum, supplied by the fuel and vacuum pump, is always present when the engine is running. In the off position, the control button

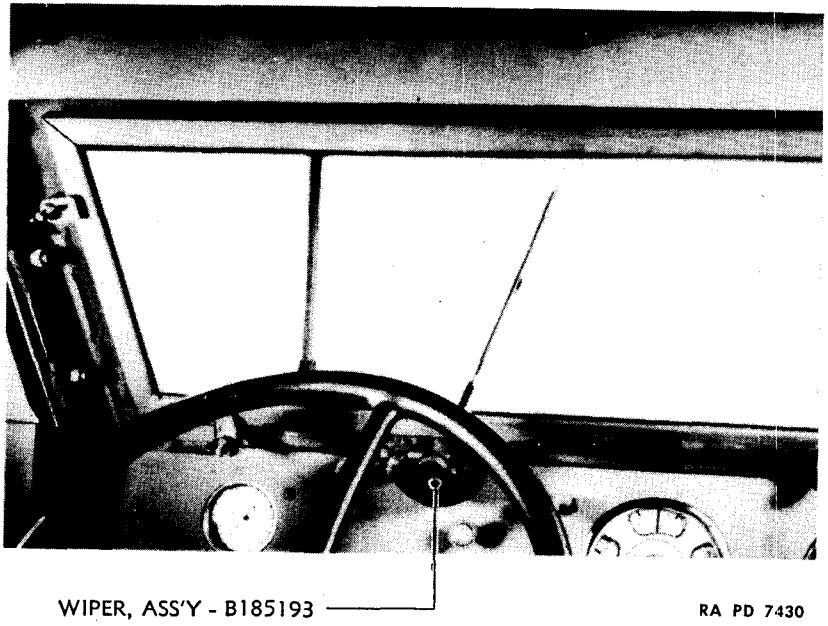


Figure 14—Windshield Wiper—Installed

is pushed in so that the plate covers the exhaust ports to one side of the paddle. In this position, air can only be exhausted from one side of the paddle and atmospheric pressure on the opposite side forces the paddle to its up position and holds it there.

(b) When the control is pulled out to its on position, the control plate opens the ports leading to both sides of the paddle. The valve located at the side of the wiper is actuated by the kicker, which oscillates with the paddle shaft, and opens and closes the exhaust ports, first to one side of the paddle and then to the other side in the following manner: Air is drawn from the body of the wiper, causing a partial vacuum, and the atmospheric pressure behind the paddle forces the paddle to move to the side of the case from which the air has been drawn; just before the paddle reaches the top of its stroke, the kicker moves the valve so that it opens the atmospheric side of the body to the vacuum; air is drawn into the former vacuum side, and hence the paddle reverses its direction. The wiper blade arm is attached to the paddle shaft, and this makes the blades oscillate with the shaft and wipe the windshield.

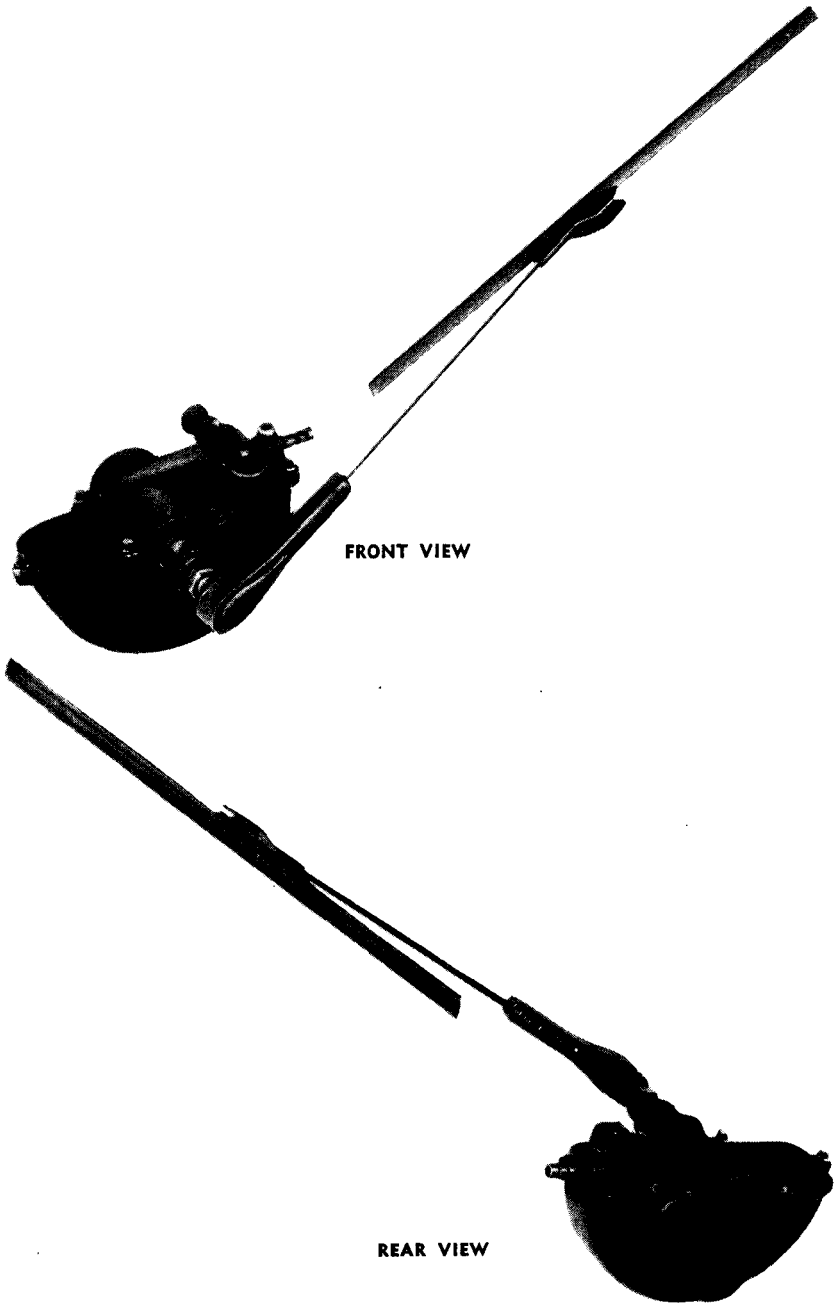


Figure 15—Windshield Wiper Assembly

(3) SPECIFICATIONS.

Make	Trico	Ordnance No.	B185193
Type	Vacuum	White No.	376642
Model No.	618A	Autocar No.	16W3823
Manufacturer's No.	KSB-443	Diamond T No.	N1601

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) WIPER MOVES VERY SLOWLY.	
Poor vacuum.	Check lines for leaks and replace hose or pipe, if necessary. Check vacuum pump for leaks, and tighten diaphragm screws. Replace vacuum pump diaphragm, if necessary.
Clogged exhaust ports.	Clean ports.
Lack of lubricant.	Lubricate paddle lightly.
Worn paddle seal (allowing air to pass by).	Replace paddle assembly.
Worn cover gaskets.	Replace gaskets.
(2) WIPER MOVES IN ONE DIRECTION ONLY.	
One set of ports clogged.	Clean ports.
Lack of lubricant.	Lubricate paddle lightly.
Kicker spring has taken a permanent set or is damaged.	Replace spring.
(3) WIPER WILL NOT MOVE.	
Hose or pipe assembly split.	Check and replace damaged part.
Worn pump diaphragm.	Replace diaphragm.
Clogged ports.	Clean ports thoroughly.
Worn or damaged cover gaskets.	Replace gaskets.
Worn or damaged paddle seal.	Replace paddle assembly.
Paddle frozen in one spot.	Free and lubricate lightly.
(4) WIPER STREAKING WINDSHIELD.	
Worn or damaged wiper blade.	Replace blade assembly.
Insufficient wiper arm pressure.	Replace wiper arm.

c. Removal of Assembly.

Wrench, open-end, $\frac{7}{16}$-in.

(1) REMOVE BLADE AND ARM ASSEMBLY.

Straighten blade arm and pull off spring clip. Then lift arm out of paddle shaft hole (fig. 16a).

(2) REMOVE MOTOR ASSEMBLY.

Wrench, open-end, $\frac{7}{16}$-in.

Pull off vacuum hose. Then remove paddle shaft sleeve nut and washer, and remove motor assembly.

d. Disassembly.

Pliers
Pliers, long nose
Screwdriver
Wrench, open-end, $\frac{7}{16}$-in.

(1) REMOVE ARM AND BLADE ASSEMBLY AND MOTOR ASSEMBLY.

Follow procedure in paragraph c above.

(2) REMOVE BLADE ASSEMBLY.

Clock blade assembly slightly, and slip it out of arm slot.

(3) REMOVE PUSH BUTTON CONTROL.

Pliers

Pry off valve mechanism cover (figs. 16b and 16c), then take out two screws from control cover and remove cover, springs, plate, pad, and button control (fig. 16d).

(4) REMOVE MOTOR ASSEMBLY COVER.

Pliers, long nose
Screwdriver

Take out six screws holding motor cover to body, and remove cover. Strip gaskets from cover (fig. 16e).

(5) REMOVE VALVE MECHANISM.

Release spring retainer and remove spring, kicker yoke, kicker, spring retainer, valve, and valve washer (figs. 16f and 16g).

(6) REMOVE PADDLE ASSEMBLY.

Lift paddle assembly straight out of body, being careful not to damage seal (fig. 16h).

e. Maintenance.

(1) When wiper blades become worn or damaged, the blade assembly should be removed from arm, without any further disassembly, and replaced with a new unit.

(2) At the 6,000-mile check-up, the wipers should be disassembled, the ports cleaned out, and all parts carefully inspected. Any damaged or worn parts should be replaced, the paddle should be lubricated, and new gaskets should be used for reassembling. NOTE: When replacing the paddle, slide it into the body vertically so that the seals will not be damaged.

(3) Inspect the leather washer at the inner side of the windshield and replace if necessary.

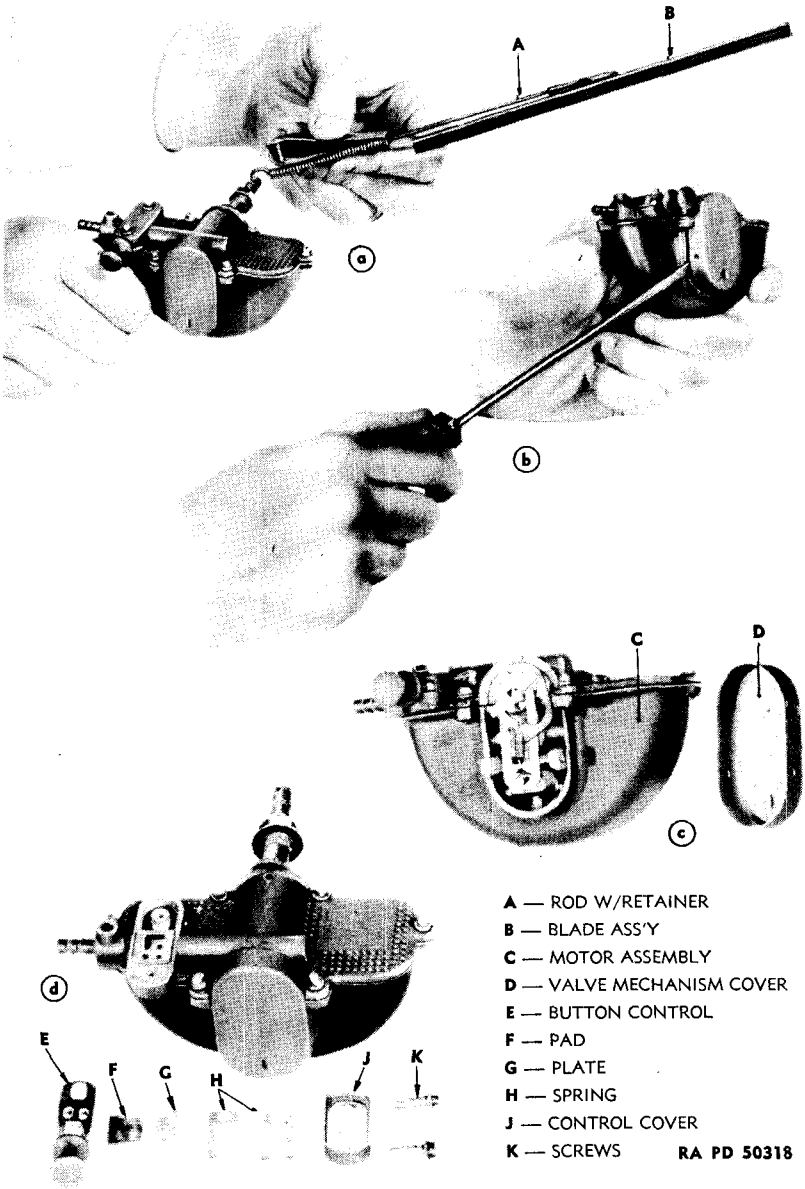
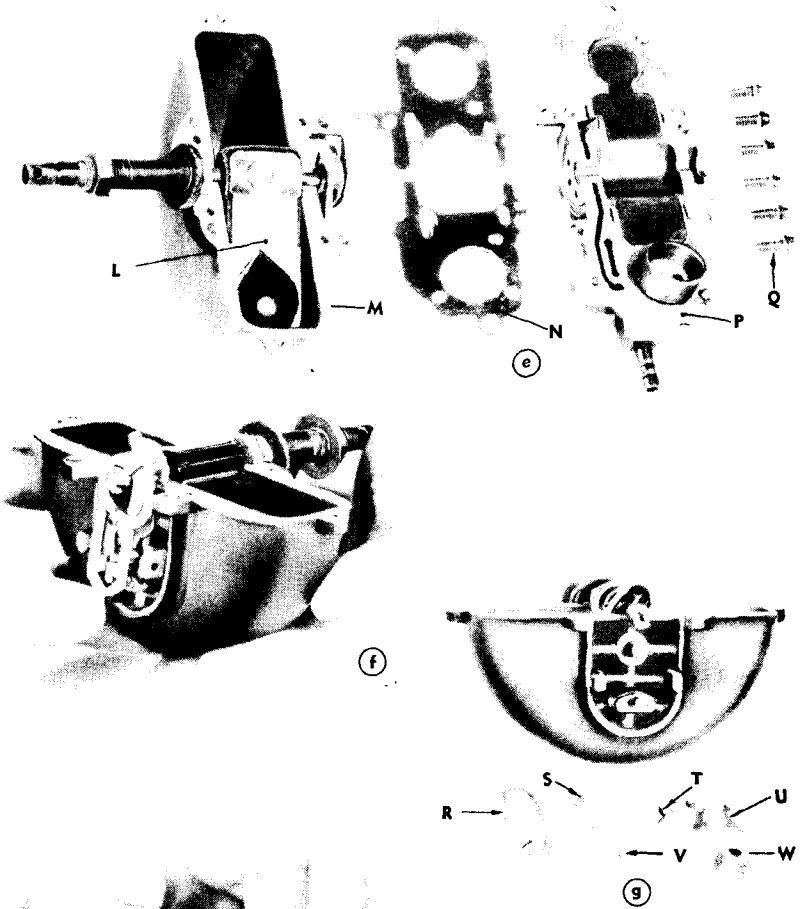


Figure 16—Windshield Wiper Disassembly and Assembly

BODY AND SHEET METAL



L — PADDLE AND SHAFT, ASS'Y
M — BODY
N — COVER GASKETS
P — COVER
Q — SCREWS
R — SPRING RETAINER
S — KICKER YOKE
T — VALVE KICKER
U — VALVE
V — SPRING
W — FELT WASHER **RA PD 50319**

Figure 16A—Windshield Wiper Disassembly and Assembly

(4) The rubber hoses should be inspected periodically and replaced if they show signs of cracking.

f. Reassembly.

Pliers — Pliers, long nose

(1) REPLACE THE PADDLE ASSEMBLY. Slip paddle assembly into body vertically (fig. 16).

(2) REPLACE THE VALVE MECHANISM. Set valve washer in place. Then in order named, replace valve, spring retainer, and kicker yoke into slot at top of kicker, attach spring to bottom of yoke and retainer, and hook retainer onto its holding pin (figs. 16f and 16g).

(3) REPLACE MOTOR COVER.

Pliers, long nose

Set gaskets onto cover, and replace cover and holding screws (fig. 16e).

(4) REPLACE VALVE MECHANISM COVER.

Hold cover in position, and snap it in place by pushing on it.

(5) REPLACE PUSH BUTTON CONTROL.

Set control in position on top of motor cover, and replace pad, plate and springs. Fasten entire assembly with control cover and screws (fig. 16d).

g. Installation.

Wrench, open-end, $\frac{7}{16}$-in.

(1) ATTACH MOTOR ASSEMBLY TO WINDSHIELD.

Wrench, open-end, $\frac{7}{16}$-in.

Push paddle shaft through windshield frame, and fasten assembly by replacing shaft sleeve washer and nut.

(2) ATTACH WIPER ARM TO PADDLE SHAFT. Push hooked end of arm into paddle shaft hole. Then set narrow end of arm spring clip over spring, compress spring, and push wide end of clip into slot cut around end of paddle shaft (fig. 16a).

(3) REPLACE WIPER BLADE ASSEMBLY. Hook blade assembly into wiper arm slot.

Section V

BOGIE SUSPENSION AND TRACK

	Paragraph
Description	13
Trouble shooting	14
Removal of assembly	15
Disassembly of components	16
Maintenance	17
Reassembly of components	18
Installation of assembly	19

13. DESCRIPTION (fig. 17).

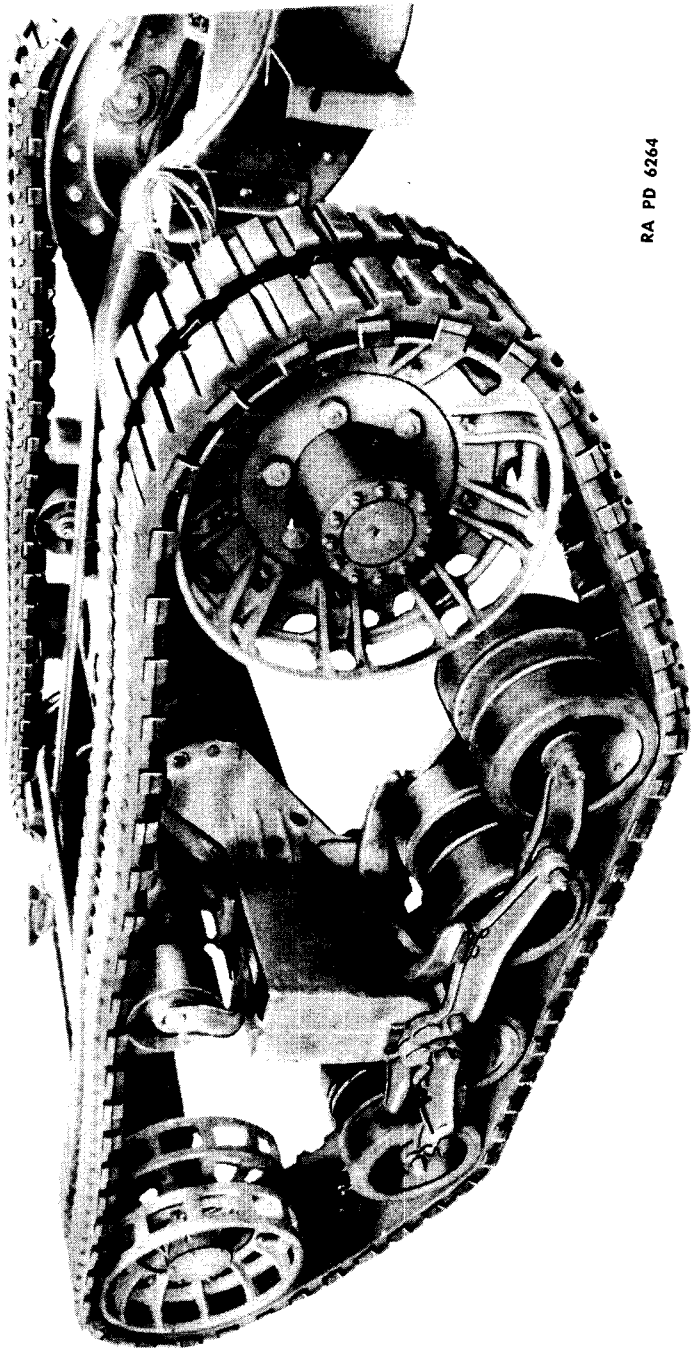
a. Construction.

(1) TRACK (fig. 18). This is of the endless type and is made of rubber molded around steel cables, which extend throughout its length to prevent any stretching. Metal guides are bolted along the center line of the track and act as contact teeth for the drive sprocket teeth. The tracks are constructed with tabs along the edges, and the wing bolts for attaching the grousers are hooked over these tabs.

(2) BOGIE (fig. 19).

(a) This consists of a bracket which is bolted to the frame and which has the guide slides for the crab assembly bolted to its inner sides. The crab contains a gudgeon bolt to which is pinned the guide slide blocks and which also carries the bushing mounted spring block that supports the dual volute springs. To each of the four crab feet is bolted a hardened steel slide which rests on hardened steel plates bolted to the carrying sidearms. These arms are steel castings and have a trunnion welded to one end, and the other end is bolted to the bogie wheel frame. The trunnion sets into a bushed hole in the bogie frame bracket and is held in place by the tie bolt and nuts. The bogie wheels are of steel and have a solid rubber tire molded onto them. The wheels are bolted to a welded hub and flange by means of studs threaded and welded into the flange. The hubs are mounted on gudgeon bolts that are fitted with roller bearings which are protected by grease shields. These wheel gudgeons are threaded on one end for a nut, which holds it to the roller frame, and the other end is made rectangular and fits into an opening of the same shape in the opposite frame. The frames are held rigid by a spacer shaft which also supports the carrying sidearms.

(b) The bogies are held in alinement by means of a tubular cross support which connects to the bogie frame brackets.



RA PD 6264

Figure 17—Bogie and Track Assembly

BOGIE SUSPENSION AND TRACK

Figure 18—Bogie Track Assembly

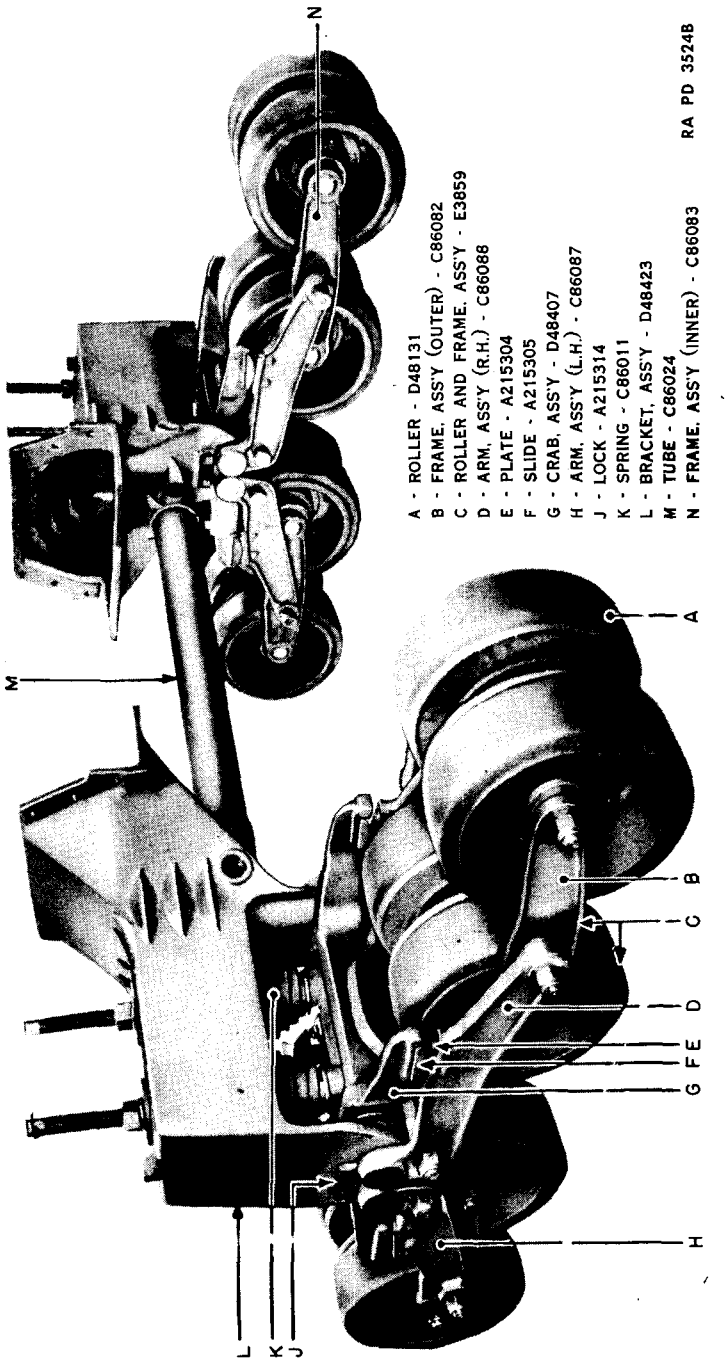


Figure 19—Bogie Assembly

(c) (figs. 20 and 21). The top (supporting) roller is mounted on a gudgeon on roller bearings which are protected by grease shields. The gudgeon is supported by brackets which are bolted to the top of the bogie frame bracket.

(3) ADJUSTING IDLERS (figs. 22 and 23).

(a) Each idler is mounted on ball bearings which are protected by grease seals and the idler hub cap which also carries the lubricating plug. The outer bearing is held in place by a nut and washer which fit onto the outer end of the shaft. The shaft passes through the lower half of the shackle and is held tightly in place by a nut and cotter pin. The upper half of the shackle swings on the idler post which is supported by two brackets, one on the inside and one on the outside of the frame. The post is held in place by a washer, nut, and cotter pin at each end. Cast integrally with the bottom of the shackle is a boss which contains a tapered hole to accommodate the anchor pin passing through one end of the adjusting rod. The pin is held in place by a nut. The free end of the adjusting rod passes through an enlarged hole in the anchor bracket attached to the frame and has a brass nut on each side of the bracket for adjusting purposes.

(b) Six equally spaced studs are screwed in and spot-welded to the idler, and upon these is mounted a flange which is secured with lock washers and nuts.

b. Operation.

(1) TRACKS. The tracks are driven by the front drive sprockets and then pass under the bogie rollers, over the adjusting idlers, and over the top (supporting) rollers. They are adjusted for slackness or tightness by means of the adjusting idler as explained below. The track guides run in grooves in the rollers and idlers, and this keeps the track running straight and prevents them from being thrown. The tracks are of themselves, nondirectional units and can be operated equally well in either direction, but the track guides which are attached to the tracks by track guide assembly bolts and nuts are directional. Care must be exercised in attaching the guides to the tracks. The vertical vanes on one end of a track guide are more closely spaced than are the vanes on the other end of the guide. This arrangement of vanes permits an overlapping of the vanes on one guide with those of the next guide to provide an unbroken or continuous guide for the track. The track guides are properly overlapped when the closer spaced guide vanes of one guide operate between the wider spaced guide vanes of the next guide.

(2) BOGIE. The bogie rollers roll on the inside of the tracks as the tracks are laid down by the sprockets. The up and down movements of

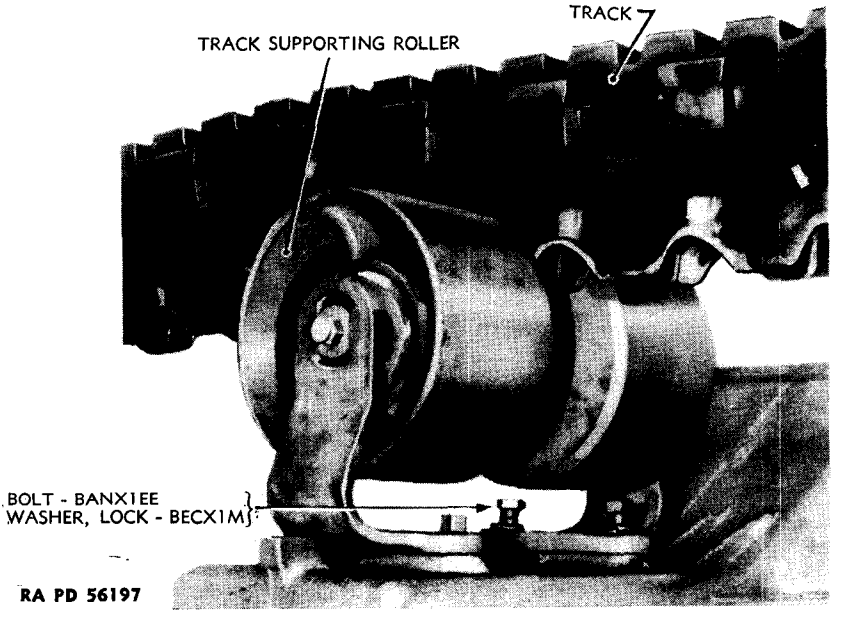
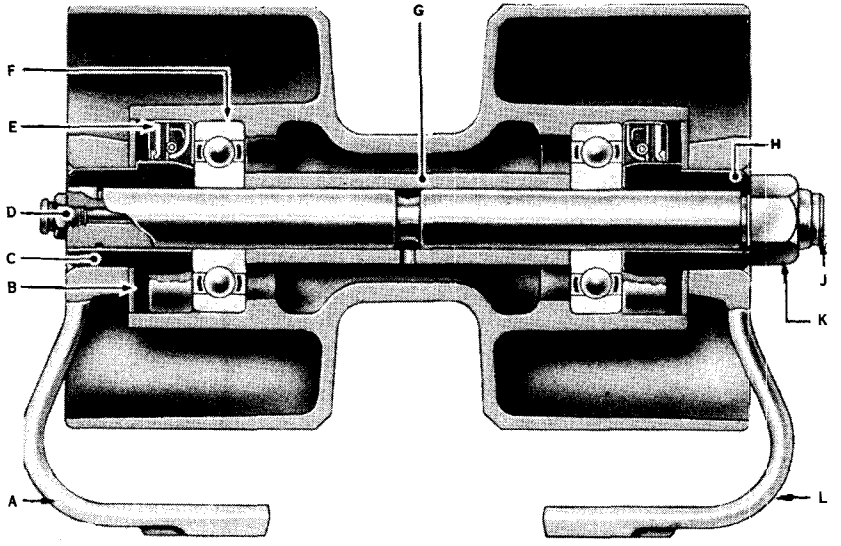


Figure 20—Bogie Top Rollers—Installed



A - BRACKET - B185414 D - FITTING - CLDX1A G - SPACER - B185113 K - NUT - A215353

B - WASHER - A215310 E - SEAL - A215316 H - PIN - A215308 L - BRACKET - B185415

C - PIN - A215309 F - BEARING - A215301 J - BOLT - B185118

RA PD 3526A

Figure 21—Bogie Top Rollers and Bracket—Sectionalized

BOGIE SUSPENSION AND TRACK

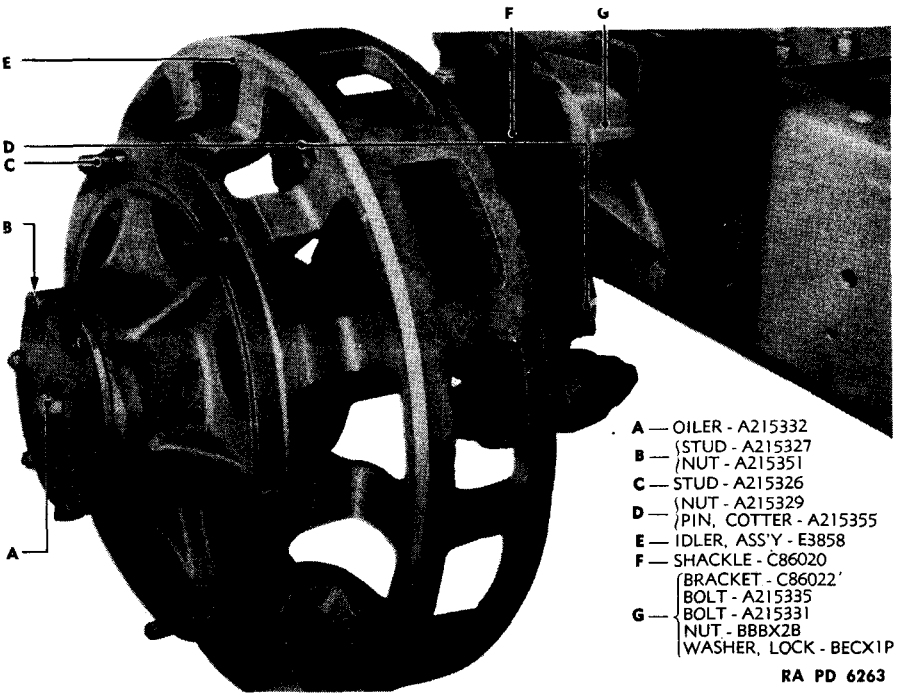


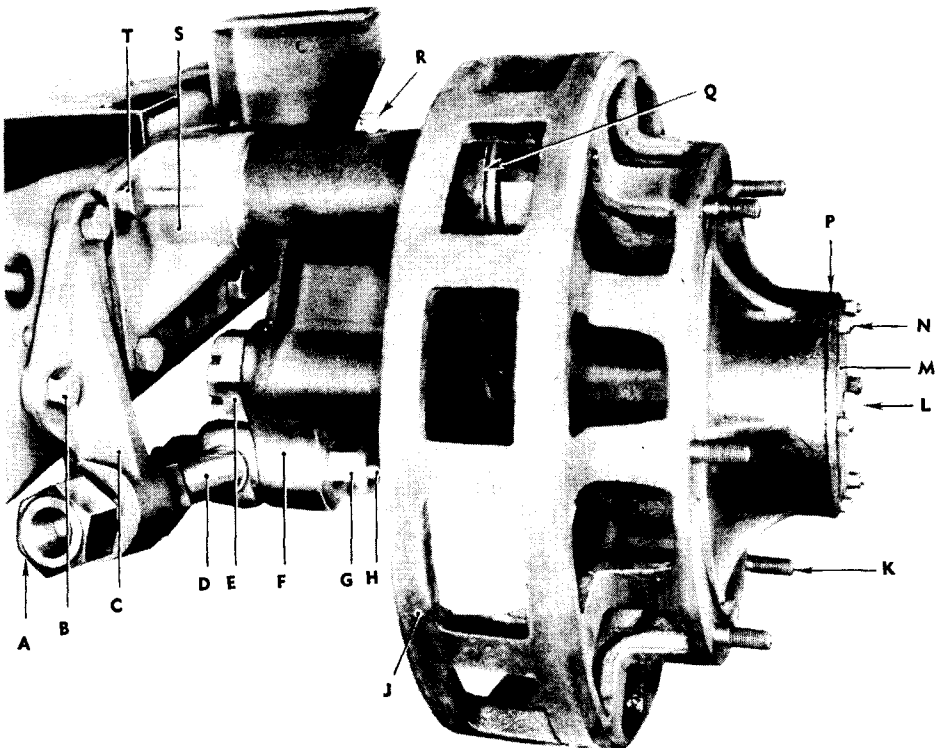
Figure 22—Track Adjusting Idler—Installed, Front View

the tracks as distorted by obstacles are transferred by the bogie rollers to the sidearms, which pivot on the trunnions and transmit the movements to the crabs. These in turn pivot on their gudgeon pins and also slide vertically in the guide slides, thus causing the volute springs to absorb the shock.

(3) TRACK ADJUSTING IDLERS. These are made to rotate by the tracks passing over them. They are adjusted by loosening the anchor pin nuts and either the upper or lower bronze nut, after which the opposite bronze nut is tightened, depending upon whether the track is to be slackened or taken up.

14. TROUBLE SHOOTING.

Symptoms and probable cause	Probable remedy
a. Throwing Track.	
Change in weight distribution.	Adjust idler.
Bent guides.	Repair or replace.
Loose idler.	Retighten.
Ice or foreign body lodged in guides or on sprocket.	Remove interfering body.



A — NUT - A215323
B — BOLT - A215344; NUT - BBBX2B; WASHER, LOCK - BECX1P
C — BRACKET - C86023
D — ROD - B185117
E — NUT - A215329; PIN, COTTER - BFAX2CF
F — SHACKLE - C86020
G — NUT - A215354
H — PIN - A215360
J — IDLER - D48409
K — STUD - A215326
L — OILER - A215332
M — CAP - A215317
N — STUD - A215327; NUT - A215351
P — GASKET - A215325
Q — WASHER - A215322
R — OILER - A215332
S — BRACKET - C86022
T — BOLT - A215335; BOLT - A215331; NUT - BBBX2B; WASHER, LOCK - BECX1P

RA PD 54071

Figure 23—Track Adjusting Idler—Installed, Rear View

b. Rollers Overheating.

Lack of lubrication.	Inspect seals and replace if necessary. Lubricate through fittings.
Bearings damaged.	Inspect bearings and replace if necessary.

c. Rear End Rides Hard.

Broken spring.	Replace spring.
Broken carrying arm.	Repair or replace arm.
Broken crab leg.	Repair or replace crab.
Cramped or sticking block in guide slide.	File edges of block or slide.

15. REMOVAL OF ASSEMBLY.

a. Track.

Bar, pinch	Lumber, 2 x 4 in., 6-ft. lengths, two
Chain and hook assembly with turnbuckle adjustment	Wrench, open-end, 2-in.
Jack, tall	Wrench, socket, 3/4-in.
Lumber, 2 x 4 in., 4-ft lengths, two	Wrench, socket, $1\frac{7}{16}$-in.

(1) CHAIN BOGIE WHEEL ASSEMBLIES IN THEIR NORMAL OPERATING POSITION.

Chain and hook assembly with turnbuckle adjustment (fig. 24).

Hook one end of chain to one bogie roller frame shaft, pass other end of chain over top of bogie frame bracket (under top roller), and hook it onto adjacent bogie roller frame shaft. Take all slack out of chain by tightening turnbuckle.

(2) RAISE REAR END OF VEHICLE.

Jack, tall

Place jack under frame side rail just back of bogie frame brackets, and raise vehicle until bogie rollers are five or six inches above ground (fig. 25).

(3) REMOVE IDLER FLANGE.

Wrench, socket, 3/4-in.

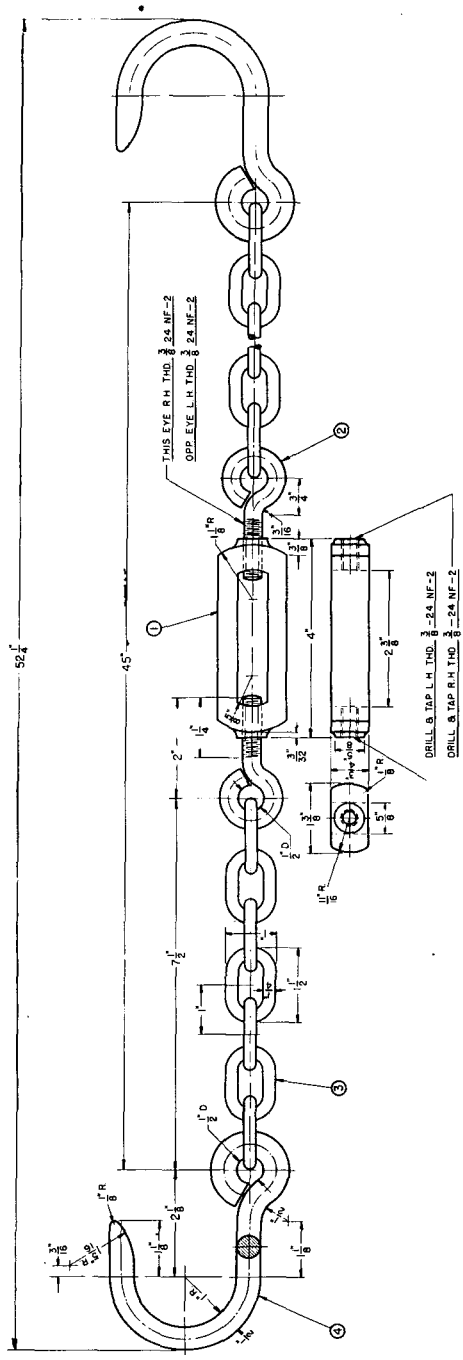
Remove six idler flange stud nuts and pull off flange (fig. 26).

(4) RELEASE ADJUSTING IDLER.

Wrench, open-end, 2-in. Wrench, socket, $1\frac{7}{16}$-in.

Loosen tapered anchor pin nuts on idler adjustment and tap outer end of pin to loosen it in its seat. Release adjusting nuts and lower idler.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES



Nº	S.A.E. Nº	PART NAME	REQ
1	1020	TURNBUCKLE	1
2	1020	TURNBUCKLE EYE	2
3		STD 1" PITCH CHAIN	37.5?
4	1020	END HOOK	2

Figure 24—Bogie and Track Removal Chain Assembly

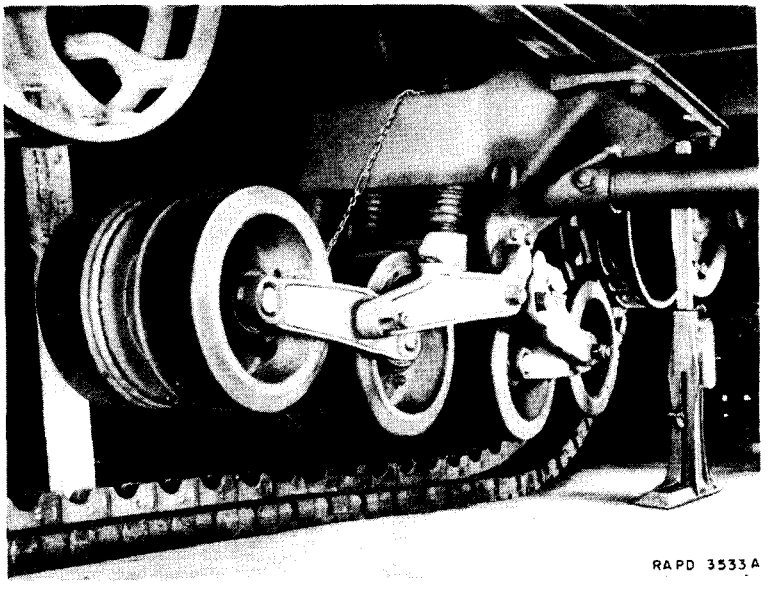


Figure 25—Bogie Raised by Chain for Track Removal

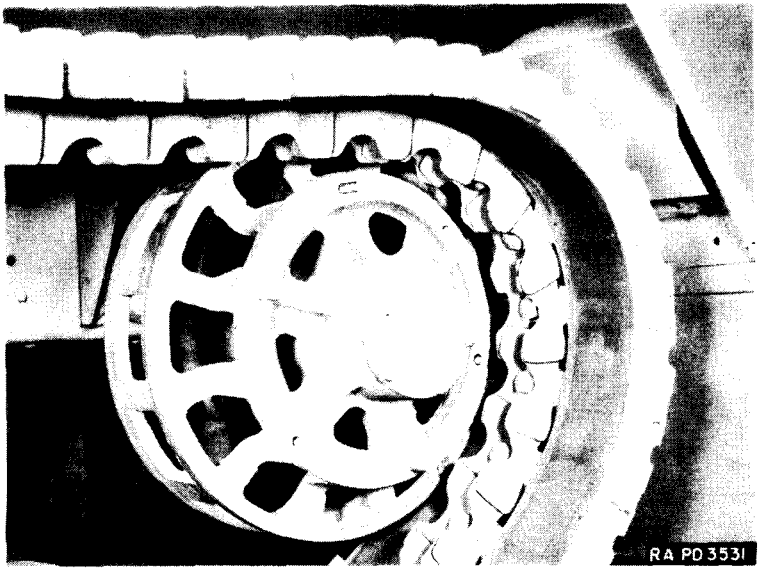


Figure 26—Idler Flange Removed for Track Removal

(5) PULL OFF TRACK.

Bar, pinch
Lumber, 2 x 4 in., 4-ft lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two

Place two 6-foot lengths of lumber between body and frame of vehicle and block them up with 4-foot lengths (fig. 27). Pull track off onto 2 x 4 inch timbers and use pinch bar, if necessary, to release track from flanges.

b. Bogie.

Bar, pinch
Chain and hook assembly with turnbuckle adjustment
Jack, tall
Lumber, 2 x 4 in., 4-ft lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two
Wrench, open-end, $1\frac{5}{16}$-in.
Wrench, open-end, 2-in.
Wrench, socket, $\frac{3}{4}$-in.
Wrench, socket, $1\frac{1}{16}$-in.
Wrench, socket, $1\frac{1}{8}$-in.
Wrench, socket, $1\frac{5}{16}$-in.
Wrench, socket, $1\frac{7}{16}$-in.

(1) REMOVE TRACK.

Follow paragraph a above.

(2) REMOVE TOP ROLLER ASSEMBLY.

Wrench, socket, $\frac{3}{4}$-in.

Remove four bolts holding top roller brackets to bogie frame bracket and take off roller assembly (fig. 28).

(3) DISCONNECT FRAME BRACKET FROM CROSS TUBE.

Wrench, socket, $1\frac{1}{16}$-in.
Wrench, socket, $1\frac{1}{8}$-in.

Remove bogie cross tube holding bolt, nut and lock washer. Block up cross tube.

(4) REMOVE BOGIE ASSEMBLY.

Wrench, open-end, $1\frac{5}{16}$-in.
Wrench, socket, $1\frac{5}{16}$-in.

Remove eight bolts, nuts, and lock washers holding bracket assembly to frame. Place wooden blocks under bogie rollers and pull bogie assembly off cross tube onto blocks (fig. 29).

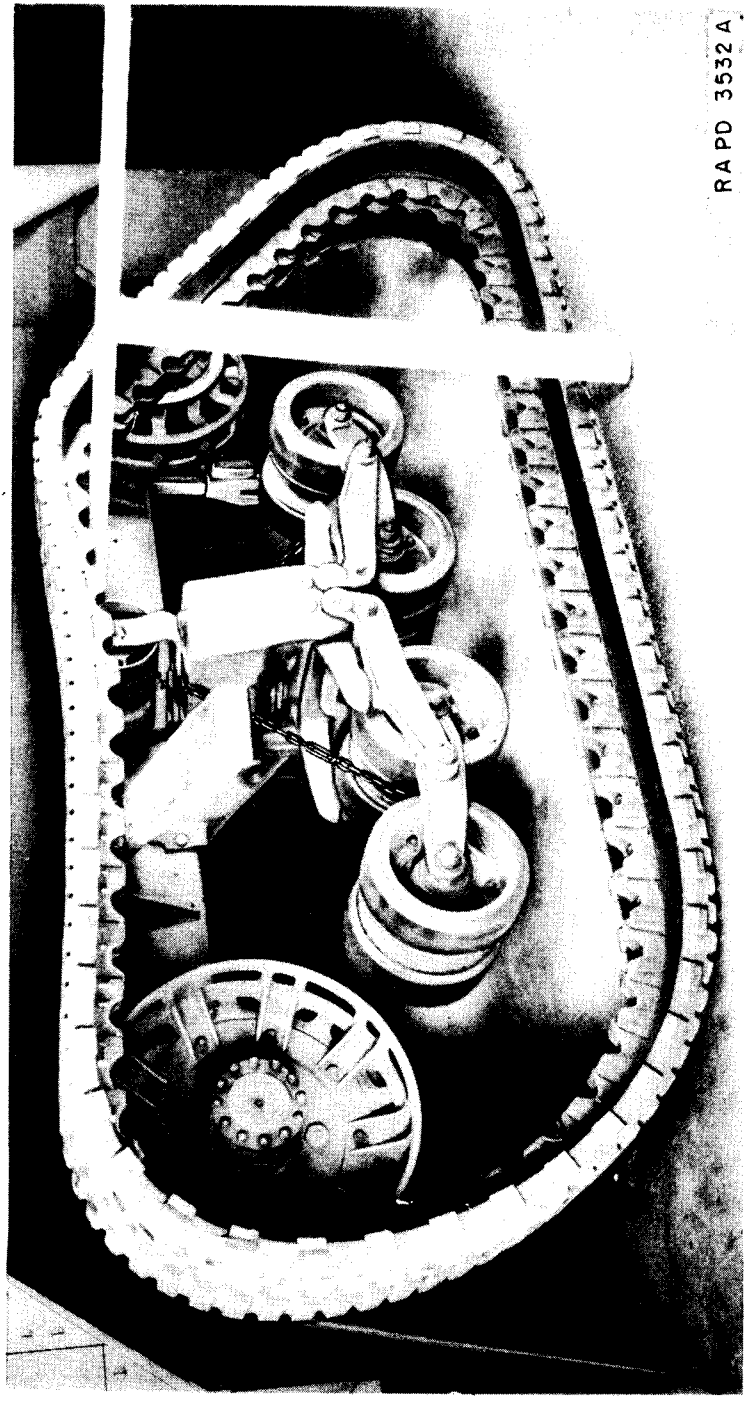
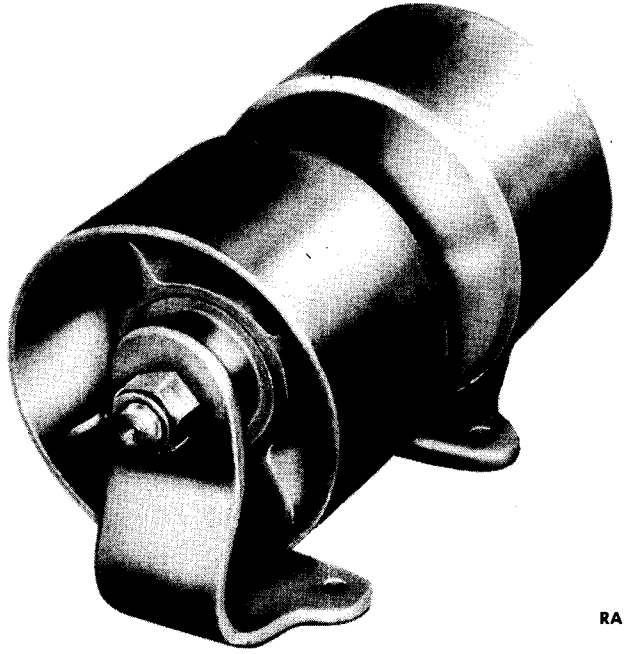
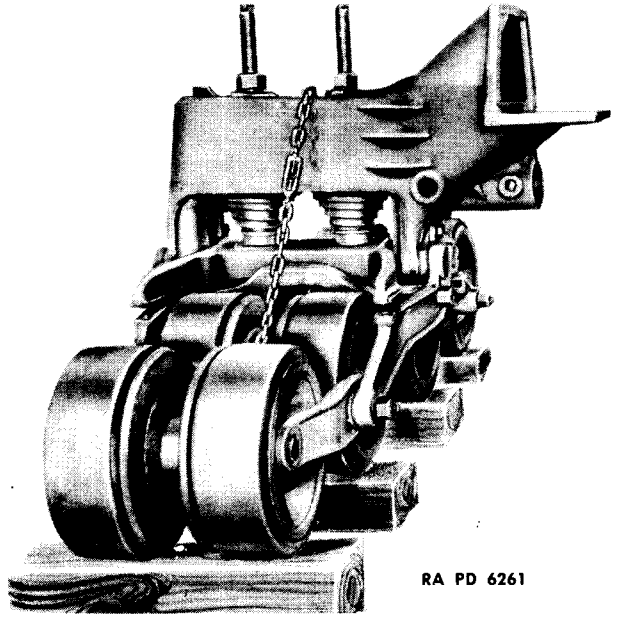


Figure 27—Track Removal



RA PD 6260

Figure 28—Bogie Top Rollers and Bracket Assembly



RA PD 6261

Figure 29—Bogie Assembly Removed

c. Track Adjusting Idler. NOTE: On later production vehicles, an idler post brace is added and must first be removed in order to remove idler post.

Bar, pinch
Chain and hook assembly with turnbuckle adjustment
Jack, hydraulic
Jack, tall
Lumber, 2 x 4 in., 4-ft. lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two
Pliers
Wrench, open-end, 2-in.
Wrench, socket, 3/4-in.
Wrench, socket, 1 7/16-in.
Wrench, socket, 2 1/2-in.

(1) REMOVE TRACK.

Follow paragraph a above.

(2) PULL ADJUSTING ROD OUT OF BRACKET.

Wrench, open-end, 2-in.

Remove outer bronze adjusting nut and swing shackle forward until adjusting rod comes free of bracket.

(3) REMOVE IDLER ASSEMBLY.

Jack, hydraulic
Pliers
Wrench, socket, 2 1/2-in.

Pull out idler post inner nut cotter pin and remove slotted nut. Using the jack, force idler post out of brackets, carrying with it the idler assembly (fig. 30).

16. DISASSEMBLY OF COMPONENTS.

a. Track.

Wrench, socket, 1 5/16-in.

(1) REMOVE GUIDES.

Wrench, socket, 1 5/16-in.

Remove guide nuts and lock washers, and take off guides.

b. Bogie. NOTE: This is usually disassembled without removing frame bracket and is treated in this manner:

Bar, pinch
Chain and hook assembly with turnbuckle adjustment
Drift
Drift, brass
Hammer
Jack, tall
Lumber, 2 x 4 in., 4-ft lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two
Puller, bearing
Screws, compressing, 7/8-in., 12-in. long, two, with nuts to fit
Screwdriver, bitstock
Wrench, box, 1 5/8-in.
Wrench, Phillips head
Wrench, open-end, 2-in.
Wrench, socket, 3/4-in.
Wrench, socket, 1 1/4-in.
Wrench, socket, 1 7/16-in.
Wrench, square socket, 5/8-in.

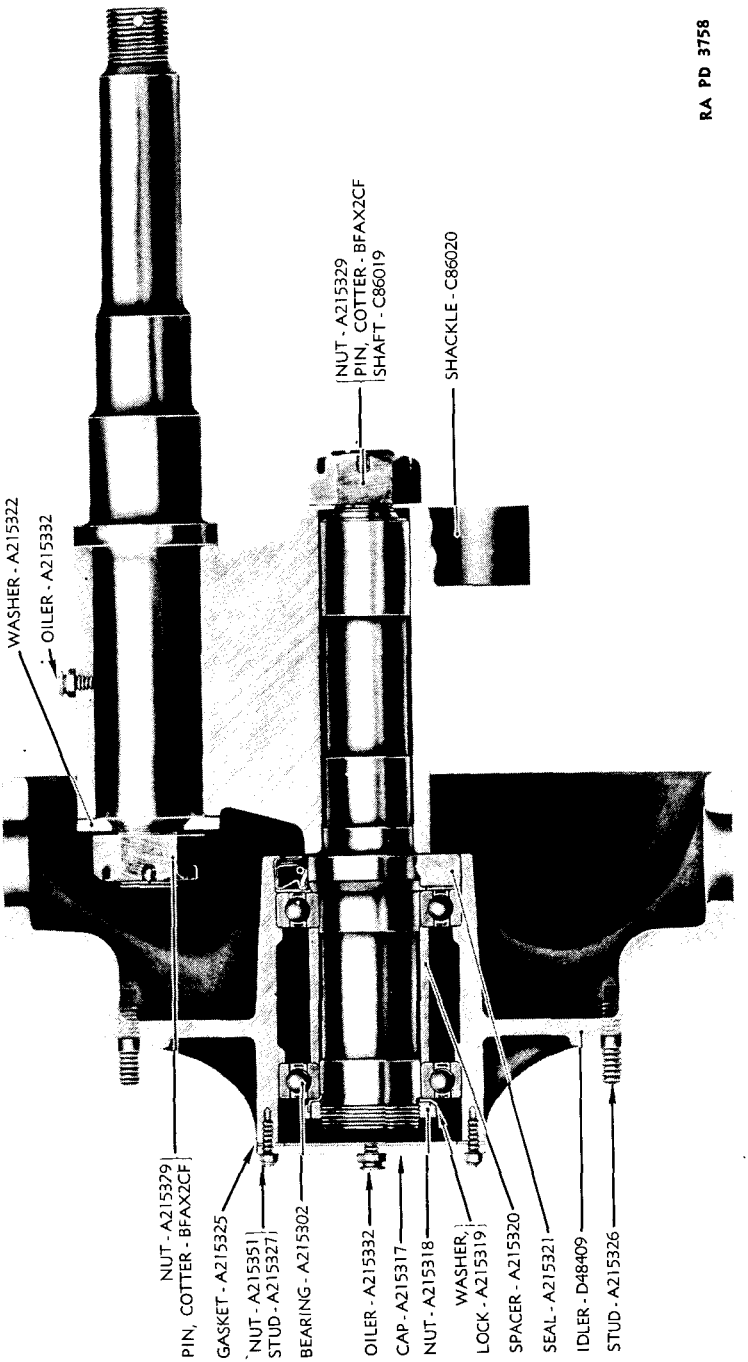


Figure 30—Track Adjusting Idler and Post—Sectionalized

BOGIE SUSPENSION AND TRACK

(1) REMOVE TRACK AND TOP ROLLER.

Follow steps (1) and (2) in paragraph 15 b above.

(2) COMPRESS BOGIE SPRINGS.

Screws, compressing, 7/8-in., 12-in. long, two, with nuts to fit
Wrench, box, 1 5/8-in.
Wrench, square socket, 5/8-in.

Screw two 7/8-inch screws into spring block and compress springs by turning down screw nuts, alternately, until crab assembly no longer rests on carrying arms (fig. 31). Release chain and hooks used for track removal.

(3) REMOVE SIDE CARRYING ARM ASSEMBLIES.

Wrench, socket, 1 1/4-in.

Remove tie bolt and bogie frame shaft nuts and pull off bogie arm assemblies (fig. 31). Use pinch bar, if necessary, to start trunnion out of frame bracket bushing. The bogie arm tie bolts and roller assemblies can also be removed at this point (fig. 32).

(4) REMOVE BOGIE FRAMES.

Drift, brass
Hammer
Wrench, socket, 1 1/4-in.

Take off roller gudgeon nuts, washers, outer frame assemblies, and frame spacer shafts. Drive bolts out of rollers and remove inner frame assemblies (fig. 33).

(5) REMOVE BOGIE FRAME BUSHINGS.

Drift
Hammer

Drive steel bushings out of frames.

(6) REMOVE BOGIE ROLLER SEALS AND BEARINGS.

Drift
Hammer
Puller, bearing

Pull bearing seals and bearings from rollers (fig. 34). (If puller is not available, drive out seals and bearings with brass drift and hammer.) Remove spacer.

(7) REMOVE BOGIE ROLLERS (RIM AND TIRE ASSEMBLIES).

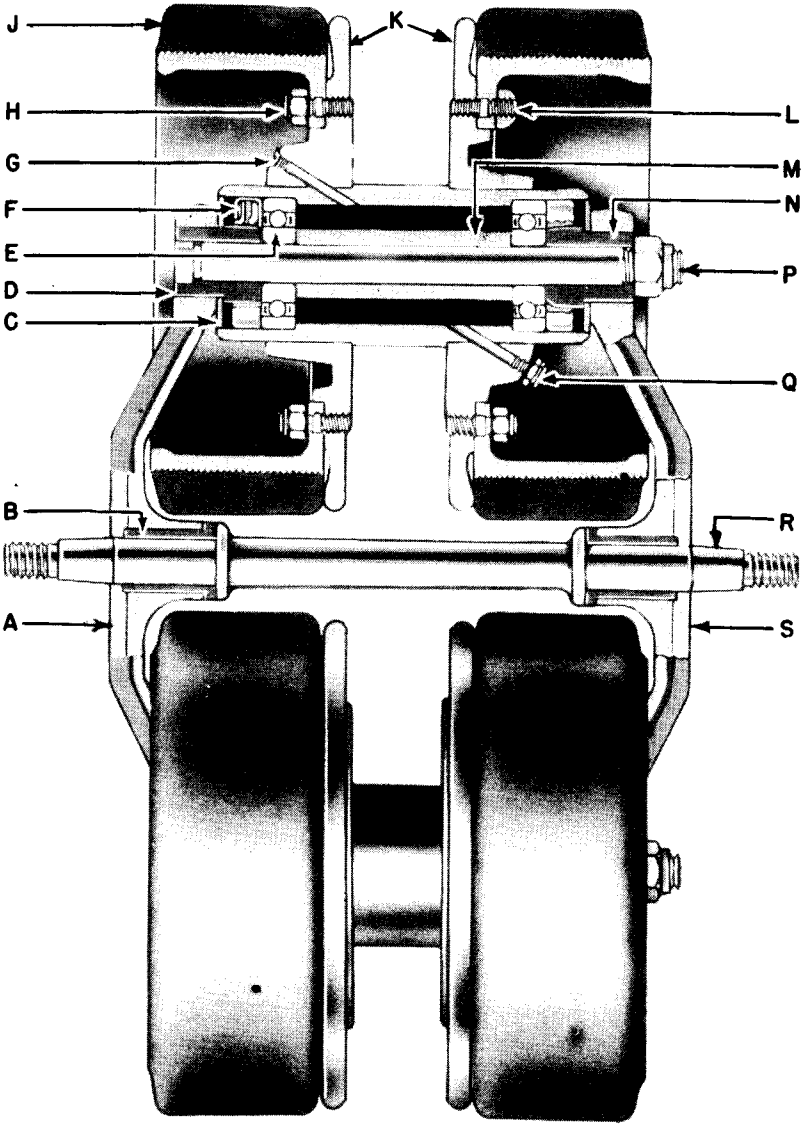
Wrench, socket, 3/4-in.

Remove six 3/4-inch nuts holding each roller to hub studs and take off rollers (fig. 35).



Figure 31—Bogie Arm Removal with Volute Springs Compressed

BOGIE SUSPENSION AND TRACK



A - FRAME, ASS'Y (INNER) - C86083
B - BUSHING - A215303
C - WASHER - A215310
D - PIN - A215309
E - BEARING - A215301
F - SEAL - A215316
G - PLUG - A215359
H - NUT - A215352
J - ROLLER - D48131
K - HUB - D48404

L - STUD - A215328
M - SPACER - B185113
N - PIN - A215308
P - BOLT - B185115
NUT - A215353
Q - FITTING - CLDX1A
R - SHAFT - C86017
S - FRAME, ASS'Y (OUTER) - C86082

RA PD 3525A

Figure 32—Bogie Lower Roller and Frame—Sectionalized

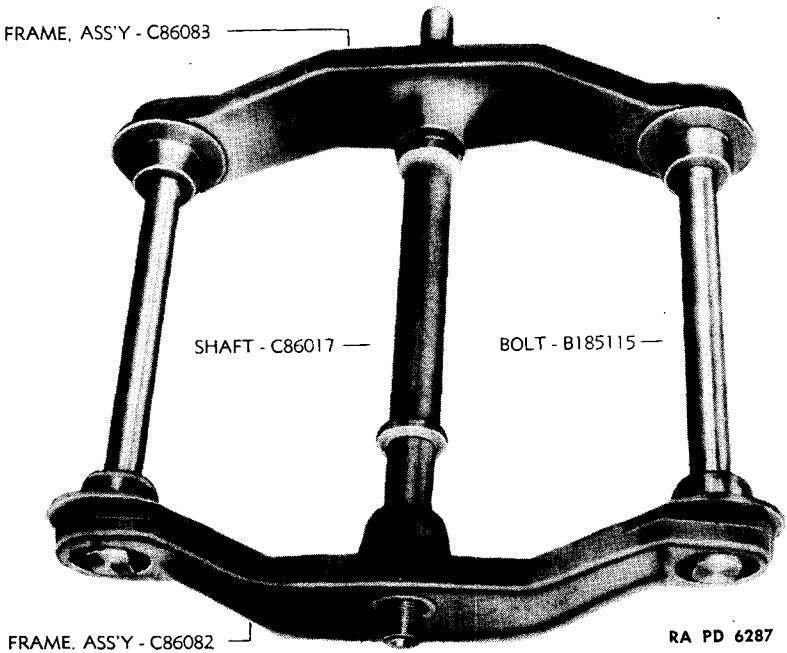


Figure 33—Bogie Roller Frame and Shaft Assembly

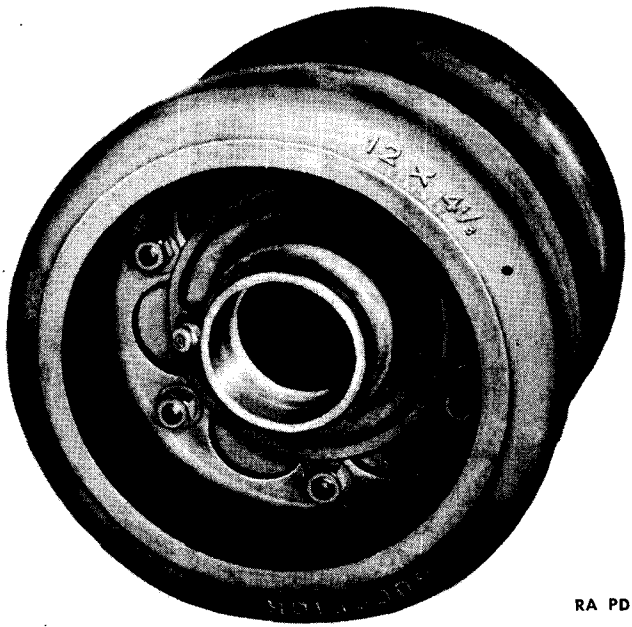
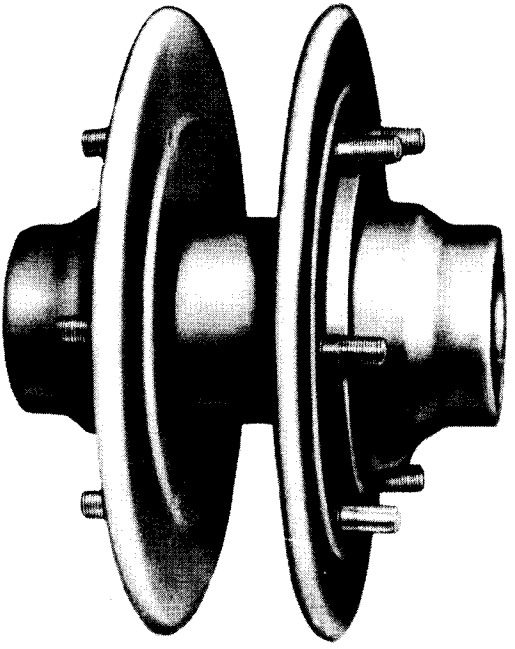


Figure 34—Bogie Roller with Bearing and Oil Seal Removed



RA PD 6258

Figure 35—Bogie Roller Rim and Tire Removal

(8) REMOVE SPRINGS AND CRAB ASSEMBLY.

Wrench, square socket, 5/8-in. Wrench, box, 1 5/8-in.

Block up assembly; then loosen nuts on spring compressing screws until all tension is removed and crab rests on blocks. Turn screws out of spring block and lower block and crab assembly, and springs to floor (fig. 36). NOTE: New bogie springs are being installed in later production vehicles and are interchangeable with former spring in sets of four only. This spring is used with or without a shim, keeping all four installations alike. A third bogie spring is to be installed, and will be interchangeable with second spring, individually, but with first spring in sets of four only.

(9) REMOVE CRAB SLIDES AND BOGIE ARM PLATES.

Screwdriver, bitstock Wrench, Phillips head

Take out two Phillips head screws holding each plate and slide (fig. 19).

(10) DISASSEMBLE CRAB (fig. 37).

Hammer

Tap out tapered pins holding crab guide blocks to spring block pin, and remove guide blocks, spring block assembly and block pin.

(11) REMOVE SPRING BLOCK BUSHINGS.

Drift, brass Hammer

Drive bushings out of spring block.

(12) REMOVE BOGIE FRAME BRACKET BUSHINGS.

Drift, brass Hammer

Drive bushings out of frame bracket (fig. 38).

(13) REMOVE BOGIE FRAME BRACKET GUIDE SLIDES.

Wrench, socket, 3/4-in.

Take out screws holding guide slides to frame and remove slides (fig. 38).

(14) REMOVE BOGIE FRAME BRACKET.

If it is necessary to remove bracket, follow steps (3) and (4) in paragraph 15 b above.

c. Track Adjusting Idler.

Bar, pinch
Chain and hook assembly with turnbuckle adjustment
Drift, brass
Hammer
Hammer, soft metal
Jack, hydraulic
Jack, tall
Lumber, 2 x 4 in., 4-ft lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two
Pliers
Puller, wheel
Wrench, bearing nut, special
Wrench, open-end, 2-in.
Wrench, open-end, 2 1/2-in.
Wrench, socket, 7/16-in.
Wrench, socket, 3/4-in.
Wrench, socket, 1 7/16-in.

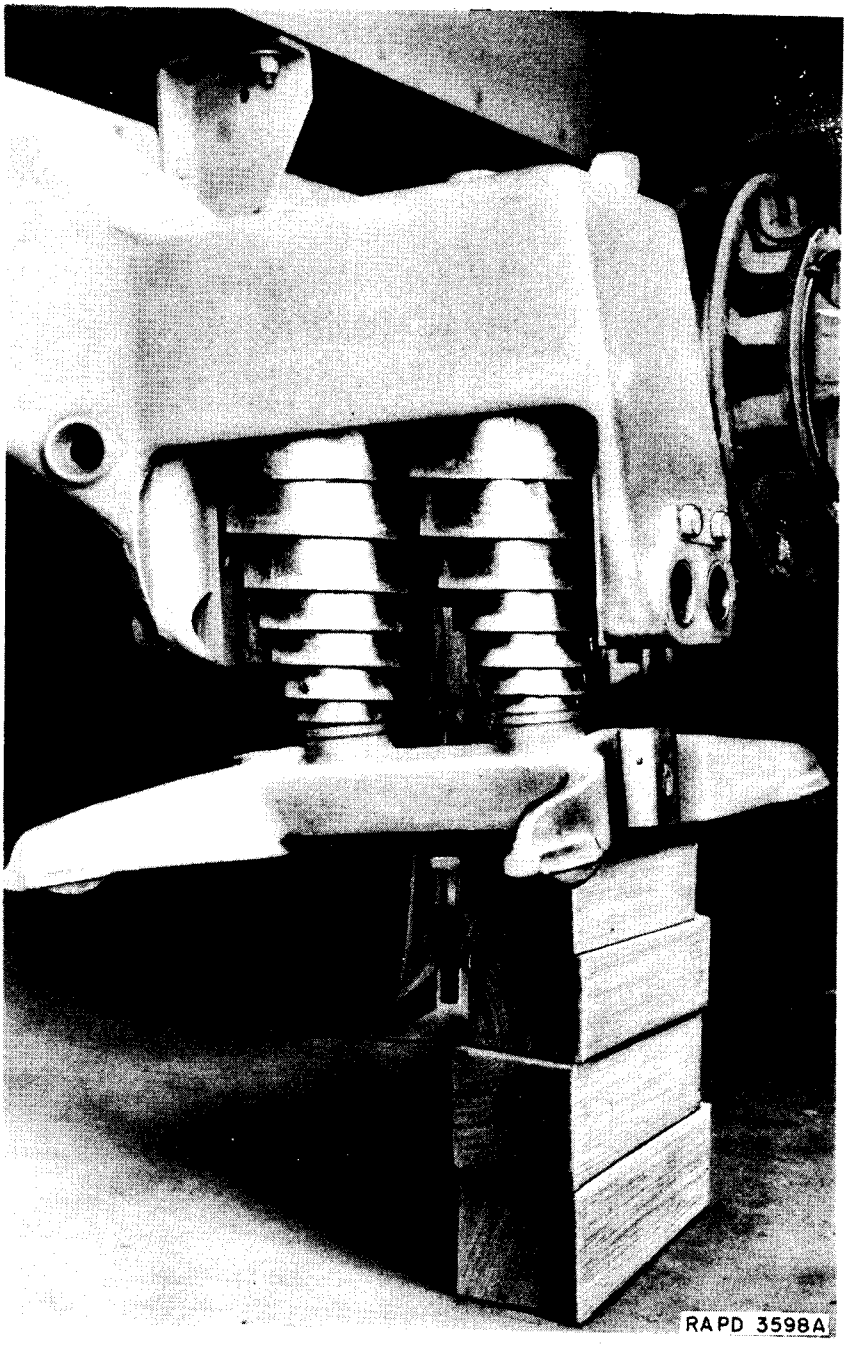


Figure 36—Bogie Volute Spring Removal

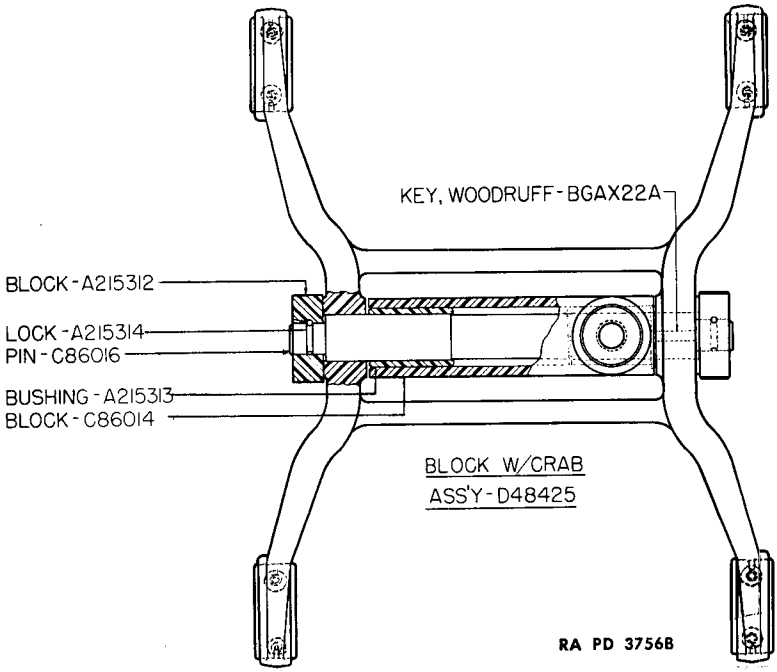


Figure 37—Bogie Crab Assembly—Sectionalized

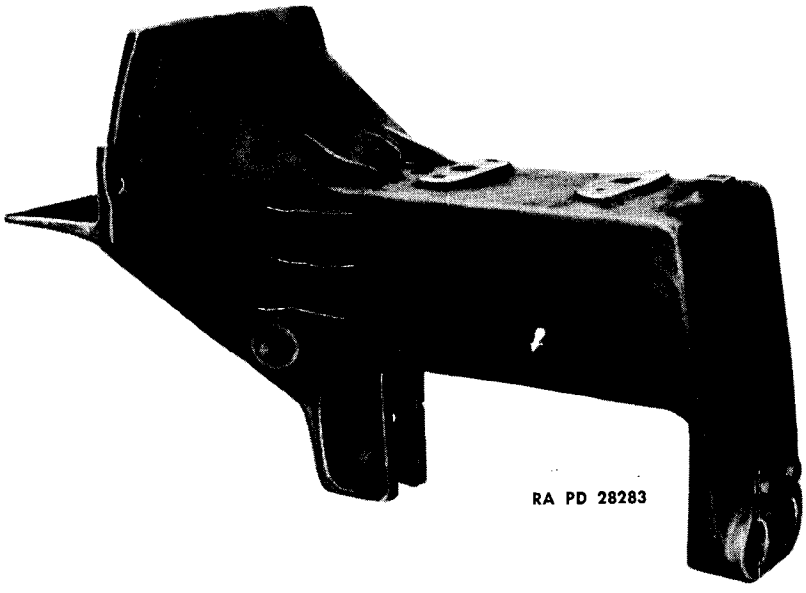


Figure 38—Bogie Frame Bracket Assembly

BOGIE SUSPENSION AND TRACK

(1) REMOVE TRACK. Follow procedure in paragraph 15 a above.

(2) REMOVE HUB COVER.

Hammer — Wrench, socket, $\frac{7}{16}$-in.

Remove hub stud nuts, tap cap in center to loosen it on its studs and pull it off with its gasket (fig. 30).

(3) REMOVE IDLER AND BEARING ASSEMBLY.

Wheel puller, special bearing nut wrench (or screwdriver and long nose chisel)

Pry bearing nut lock washer prongs from nut recesses and remove nut and washer with a special wrench or as shown in figure 39. Pull off idler assembly as shown in figure 40.

(4) REMOVE IDLER BEARINGS.

Drift, brass — Hammer

Drive bearings out of idler as shown in figure 41. NOTE: Bearing spacer must be pushed to one side to get at bearings with the drift.

(5) REMOVE ADJUSTING ROD AND ANCHOR PIN.

Hammer, soft metal — Wrench, socket, $\frac{7}{16}$-in.

Turn off adjusting rod outer nut and pull rod free of its bracket (fig. 42). Remove anchor pin outer nut and drive pin out of shackle. The anchor pin can now be driven out of the adjusting rod end.

(6) REMOVE SHACKLE AND IDLER SHAFT ASSEMBLY.

Pliers — Wrench, open-end, 2½-in.

Pull cotter pin from idler post nut, and remove nut and washer. Pull shackle and shaft assembly from idler post.

(7) DISASSEMBLE IDLER SHAFT.

Drift, brass — Pliers
Hammer — Wrench, open-end, 2½-in.

Pull out idler shaft, cotter pin, and remove nut. Drive shaft out of shackle and tap bearing seal off shaft.

(8) REMOVE IDLER POST FROM BRACKETS.

Jack, hydraulic — Wrench, open-end, 2½-in.
Pliers

Pull cotter pin from idler post inner nut, and remove nut. Then wedge jack between inner end of idler post and frame, and force post out of its brackets.

d. Top (supporting) Roller.

Drift, brass — Wrench, open-end, 2-in.
Hammer — Wrench, socket, ¾-in.
Hammer, soft metal — Wrench, socket, 1¼-in.
Puller, bearing — Wrench, socket, $1\frac{7}{16}$-in.

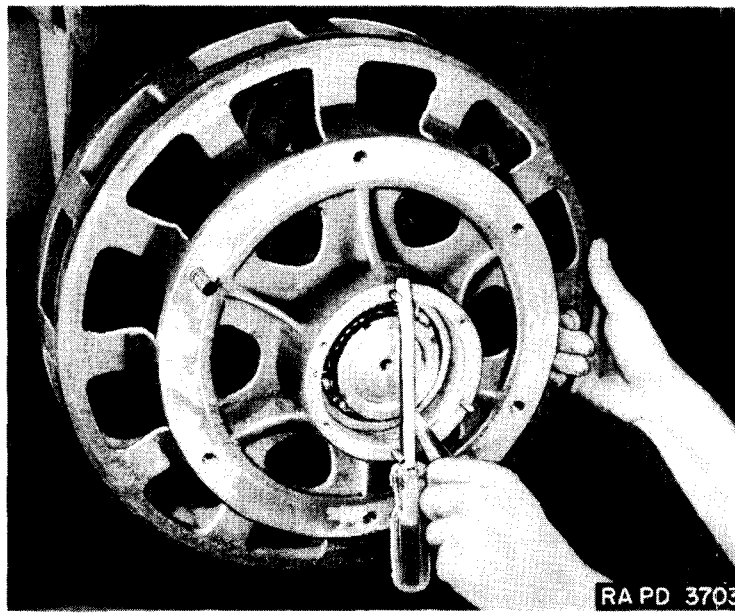


Figure 39—Track Adjusting Idler Bearing Nut Removal

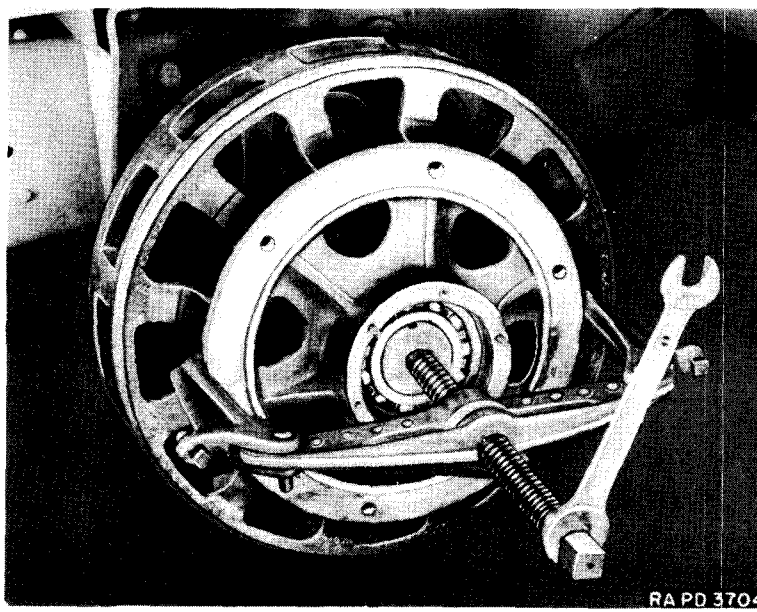


Figure 40—Track Adjusting Idler Removal

BOGIE SUSPENSION AND TRACK

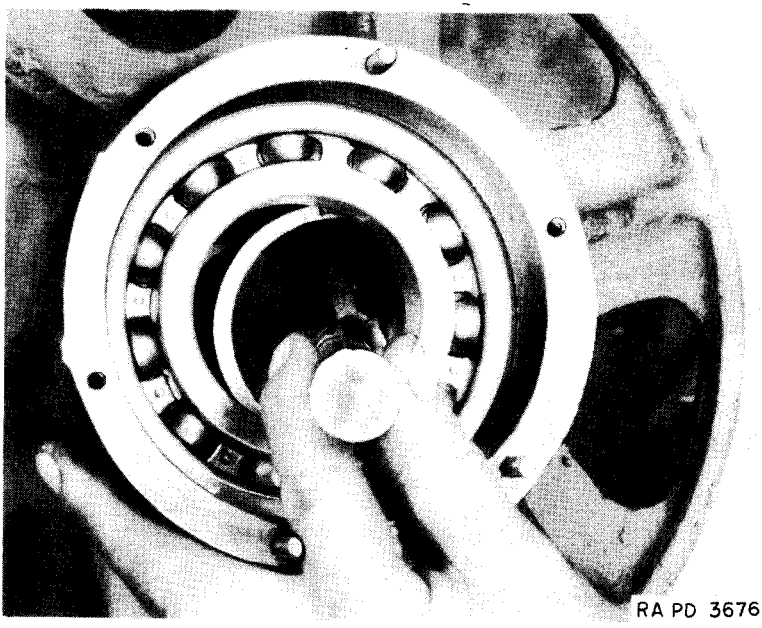


Figure 41—Track Adjusting Idler Bearing Removal

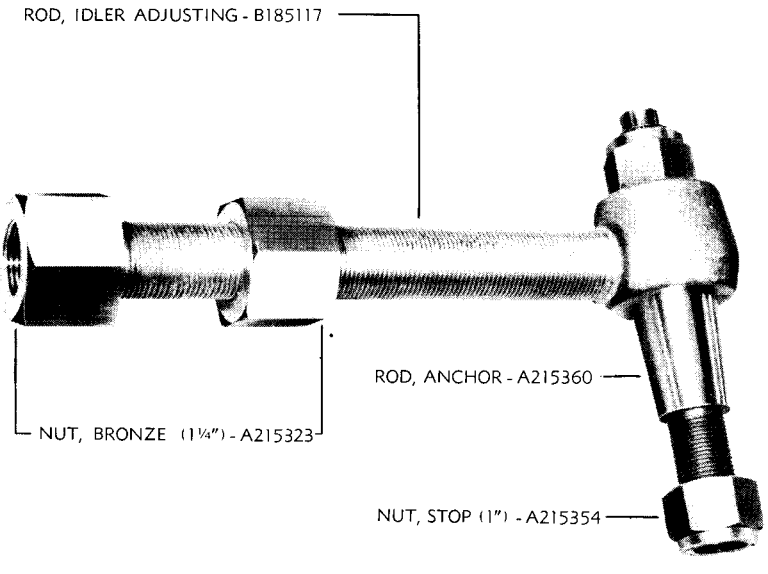


Figure 42—Track Adjusting Rod and Anchor Rod

(1) SLACK-OFF TRACK AND REMOVE ROLLER ASSEMBLY.

Hammer, soft metal
Wrench, open-end, 2-in.
Wrench, socket, 3/4-in.
Wrench, socket, $1\frac{7}{16}$-in.

Loosen tapered anchor pin nut on idler adjustment, and tap outer end of pin to loosen it in its seat. Release adjusting rod outer nut, thereby lowering idler and allowing track to become slack. Prop up track adjacent to roller (fig. 43), and remove cap screws holding roller brackets to bogie frame bracket.

(2) REMOVE ROLLER GUDGEON (bolt) (fig. 21).

Drift, brass
Hammer
Wrench, socket, 1 1/4-in.

Unscrew gudgeon nut and remove outer bracket. Then drive (or press) out gudgeon bolt. The inner bracket can then be taken off, also.

(3) REMOVE BEARINGS AND OIL SEAL.

Puller, bearing.

Pull out oil seals and bearings. If puller is not available, the bearings and seals can be driven out with a brass drift and hammer. Remove spacer.

17. MAINTENANCE.

a. Sprockets.

(1) When the sprocket teeth show signs of wear, reverse the sprocket to allow the opposite sides of the teeth to take the wear.

(2) When a sprocket tooth is broken, the sprocket should be replaced.

(3) If the sprocket bolt holes become enlarged or torn, they should be bushed or the tear welded.

b. Bogies.

(1) Worn bogie roller tires should be removed as an assembly with the rim, and replaced with new assemblies.

(2) Bogie roller hub flanges which have become bent or sprung must be straightened out. Hub flange studs which are sheared or bent must be replaced with new studs.

(3) Broken sidearms, carrying arms and crabs should be replaced.

(4) Springs which have become soft or broken must be replaced.

(5) Worn guides and guide slides should be replaced and machined so that they are in correct alinement.

(6) Check all nuts, and keep them tight at all times.

(7) For correct bearing maintenance, see Front Axle, Section V, TM 9-1710.

(8) Inspect oil seals, and if they are worn or have been damaged during removal, replace with new ones.

BOGIE SUSPENSION AND TRACK

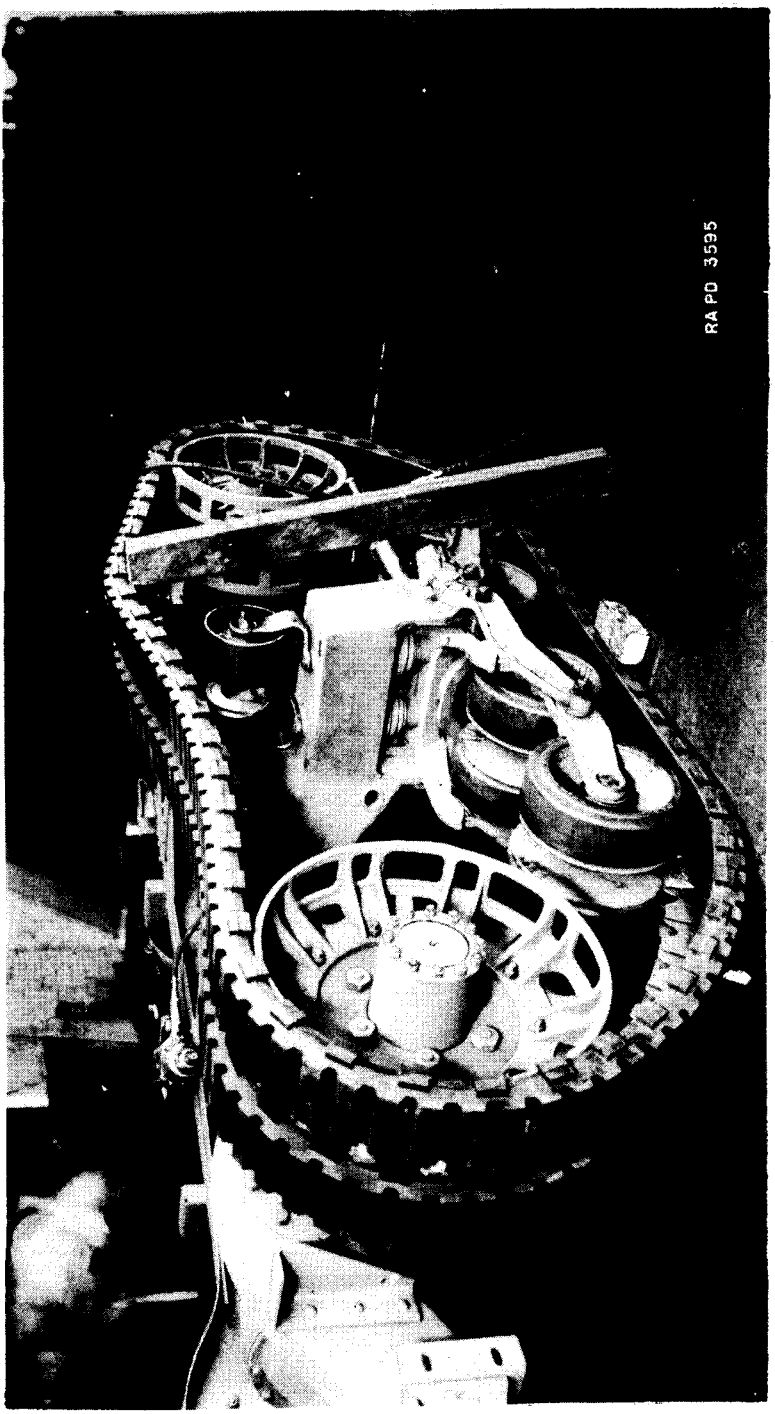


Figure 43—Bogie Top Roller Removal

(9) Inspect spring block bushings, frame bracket bushing, and bogie roller frame bushings. If they show signs of wear on either the inside or outside periphery, replace with new bushings.

c. Adjusting Idlers.

(1) Because of the manner in which the adjusting idler is hung, the shackle sometimes becomes sprung. When this occurs, the shackle should be straightened or replaced.

(2) For correct bearing maintenance, see Front Axle, Section V, TM 9-1710. When reassembling, drive bearings and spacer into idler before idler shaft is mounted. Apply pressure with a flat surface on both outer and inner races.

(3) Inspect bracket and adjusting nuts and tighten any loose ones.

d. Top (supporting) Rollers.

(1) Replace any broken or damaged end brackets.

(2) For correct bearing maintenance, see Front Axle, Section V, TM 9-1710.

(3) Inspect oil seals. If they show any evidence of wear or have been damaged during removal, replace with new seals.

18. REASSEMBLY OF COMPONENTS.

a. Track.

Wrench, socket, $1\frac{5}{16}$-in.

(1) ATTACH GUIDES TO TRACK.

Wrench, socket, $1\frac{5}{16}$-in.

Replace guides, lock washers and nuts, and tighten nuts to a tension of 100 foot-pounds.

b. Bogie.

Hammer
Jack, hydraulic
Screws, compression, $\frac{7}{8}$-in., 12-in. long, two, with nuts to fit
Screwdriver, bitstock
Tool, bearing driving
Tool, bushing driving
Tool, seal driving
Wrench, box, $1\frac{5}{8}$-in.
Wrench, Phillips head
Wrench, socket, $\frac{5}{8}$-in.
Wrench, socket, $\frac{3}{4}$-in.
Wrench, socket, $1\frac{5}{16}$-in.
Wrench, socket, $1\frac{1}{16}$-in.
Wrench, socket, $1\frac{1}{8}$-in.
Wrench, socket, $1\frac{1}{4}$-in.

(1) INSTALL BOGIE FRAME BRACKET BUSHINGS AND GUIDE SLIDES.

Hammer
Tool, bushing driving
Wrench, socket, $\frac{3}{4}$-in.

Drive frame bracket bushings into bracket. Set guide slides and bolt them in position with lock and cap screws (fig. 38).

BOGIE SUSPENSION AND TRACK

(2) ATTACH BRACKET ASSEMBLY TO FRAME.

Wrench, socket, $\frac{5}{16}$-in.
Wrench, socket, $1\frac{1}{16}$-in.
Wrench, socket, $1\frac{1}{8}$-in.

Slip frame onto cross tube and bolt to tube. Replace the eight bolts, lock washers and nuts holding bracket to frame.

(3) REASSEMBLE CRAB.

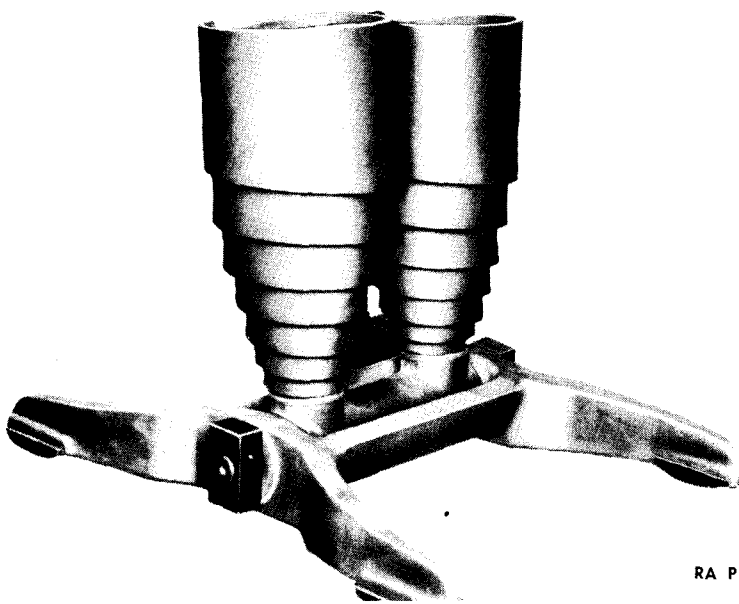
Hammer
Screwdriver, bitstock
Tool, bushing driving
Wrench, Phillips head

Attach slides to crab feet. Drive bushings into spring block, place block in position between crab feet, and install block pin. Place guide blocks onto ends of spring block pin, and press locks into place (fig. 37).

(4) REPLACE SPRINGS AND CRAB ASSEMBLY INTO BRACKET.

Jack, hydraulic
Screws, compression, $\frac{7}{8}$-in., 12-in. long, two, with nuts to fit.
Wrench, box, $1\frac{5}{8}$-in.
Wrench, socket, $\frac{5}{8}$-in.

Place springs on spring block (fig. 44) and block up assembly into position in bracket until guide blocks start to engage slides (fig. 36). (Make certain blocks enter slides in a straight position and do not cock.) Drop compression screws through holes in top of bracket and thread them into spring block. Screw nuts onto compression screws and turn them down alternately until the springs are compressed the necessary amount for attaching the bogie rollers.



RA PD 6379

Figure 44—Replacing Bogie Volute Springs on Crab

(5) REASSEMBLE BOGIE ROLLERS.

Hammer
Tool, bearing driving (fig. 45)
Tool, seal driving (fig. 46)
Wrench, socket, 3/4-in.
Wrench, socket, 1 1/4-in.

Place the bogie roller rim and tire assemblies onto the hub flange studs and draw up stud nuts (fig. 35). Drive bearings and seals into hubs (figs. 47 and 48). Drive bogie roller frame bushings into frames and assemble inner bogie frame and gudgeon bolts to rollers; hold spacer shaft in place and slip outer bogie frame onto gudgeon bolts and shaft. Replace gudgeon nuts and tighten assembly.

(6) ATTACH BOGIE ROLLER ASSEMBLIES TO BRACKET.

Wrench, socket, 1 1/4-in.

Attach plates to bogie arms. Set bogie roller assemblies on blocks in approximate operating positions (fig. 49). Hold bogie arm bolts in place and slip bogie arm assemblies onto bolts and into bracket bushings (fig. 31). Replace arm bolt and bogie frame spacer shaft nuts to hold bogie arms in place.

(7) REMOVE SPRING COMPRESSING SCREWS.

Wrench, box, 1 5/8-in.
Wrench, socket, 5/8-in.

Turn compressing screw nuts, alternately, releasing springs until crab rests on bogie arms and all tension is removed from screws. Turn screws out of spring block and remove from bracket.

(8) REPLACE TOP (SUPPORTING) ROLLER.

Wrench, socket, 3/4-in.

Bolt top-roller brackets to top of bogie frame bracket.

c. Track Adjusting Idler.

Block, wooden
Drift, brass
Hammer
Hammer, brass
Hammer, sledge
Hammer, soft metal
Screwdriver
Tool, bearing driving
Wrench, socket, 7/16-in.
Wrench, socket, 15/16-in.
Wrench, socket, 1 1/16-in.
Wrench, socket, 1 1/8-in.
Wrench, socket, 1 7/16-in.
Wrench, socket or box, 2 1/2-in.
Wrench, spanner, bearing nut, special

(1) INSTALL IDLER POST.

Hammer, soft metal
Wrench, socket or box, 2 1/2-in.

BOGIE SUSPENSION AND TRACK

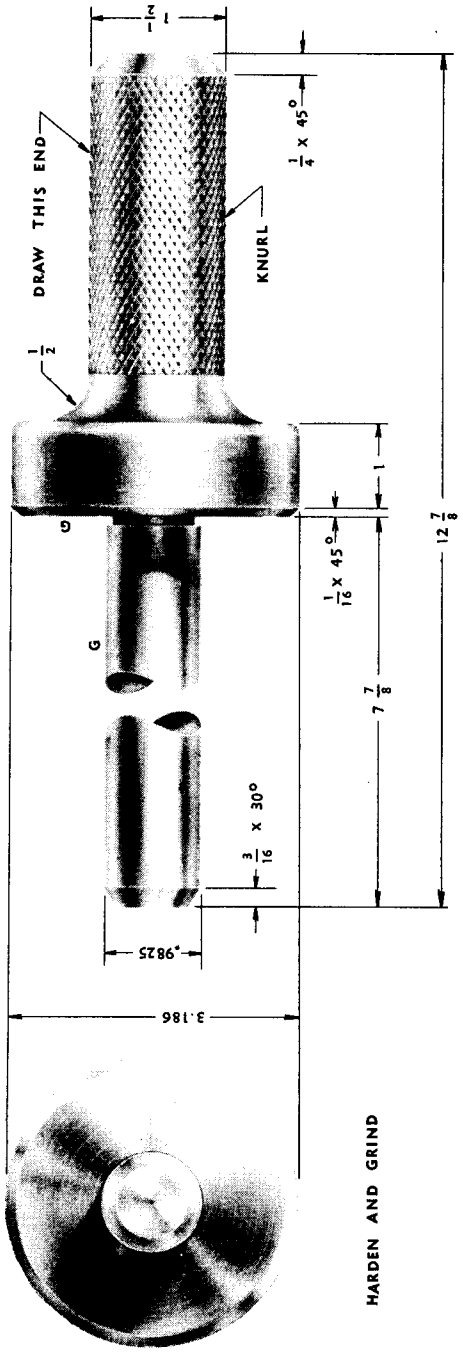


Figure 45—Bogie Roller Bearing Driving Tool

Figure 46—Bogie Roller Oil Seal Driving Tool

BOGIE SUSPENSION AND TRACK

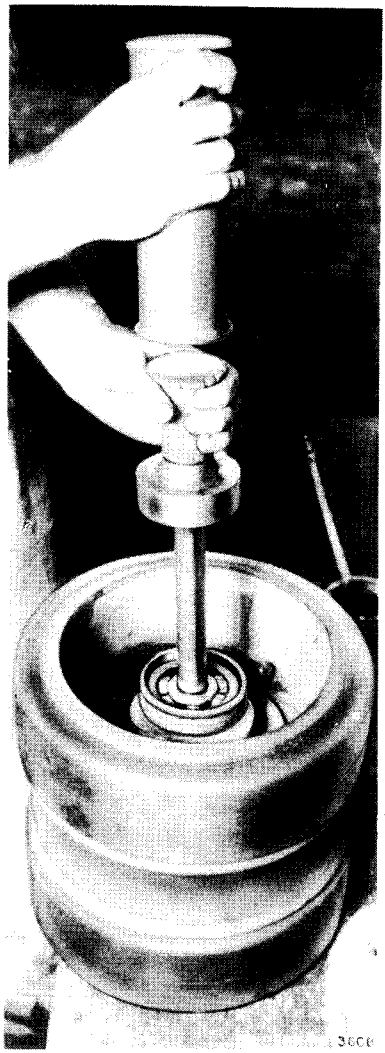


Figure 47—Bogie Lower Roller Bearing Installation

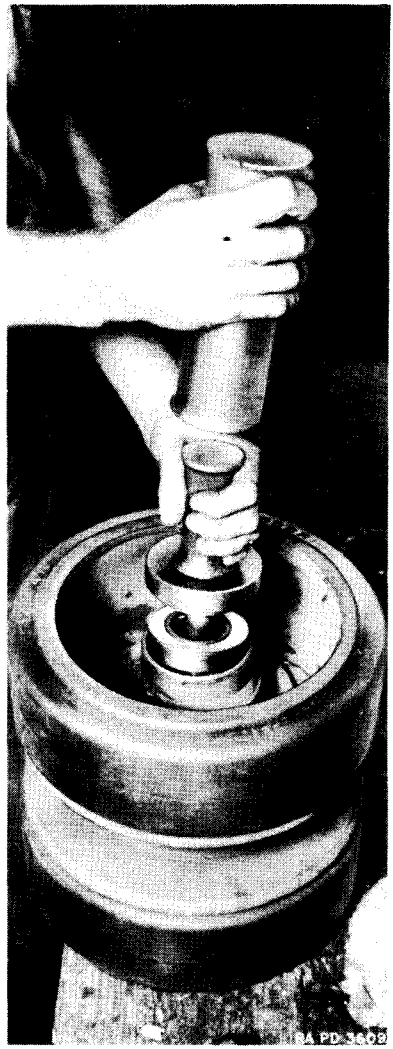


Figure 48—Bogie Lower Roller Oil Seal Installation

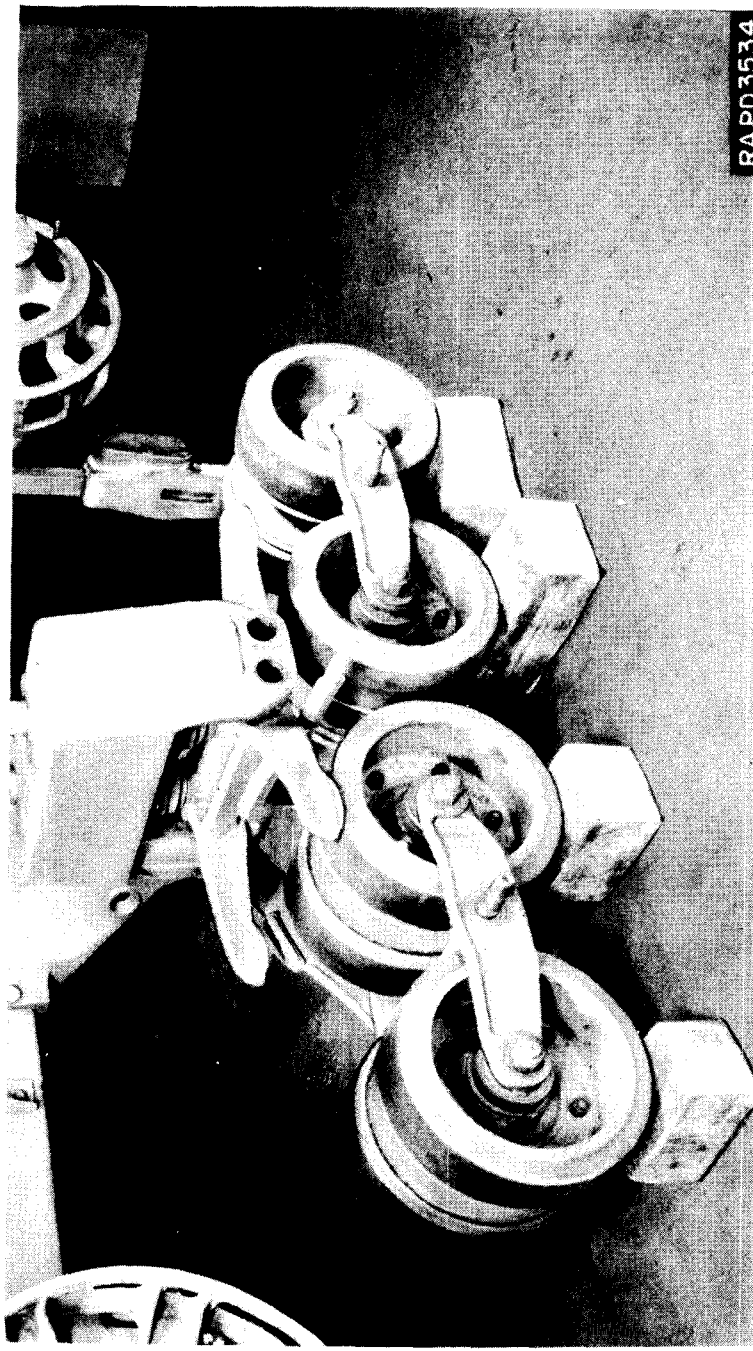


Figure 49—Bogie Lower Roller Replacement

BOGIE SUSPENSION AND TRACK

Drive idler post into its brackets, and fasten with inner nut and cotter pin (fig. 50).

(2) ASSEMBLE SHACKLE AND IDLER SHAFT TO IDLER POST.

Wrench, socket, $\frac{5}{16}$-in. Wrench, socket, $1\frac{1}{8}$-in.
Wrench, socket, $1\frac{1}{16}$-in.

Drive idler shaft into shackle and fasten with nut and cotter pin. Then slip shackle onto idler post and lock with washer, nut, and cotter pin (fig. 51).

(3) REPLACE ADJUSTING ROD AND ANCHOR PIN ASSEMBLY.

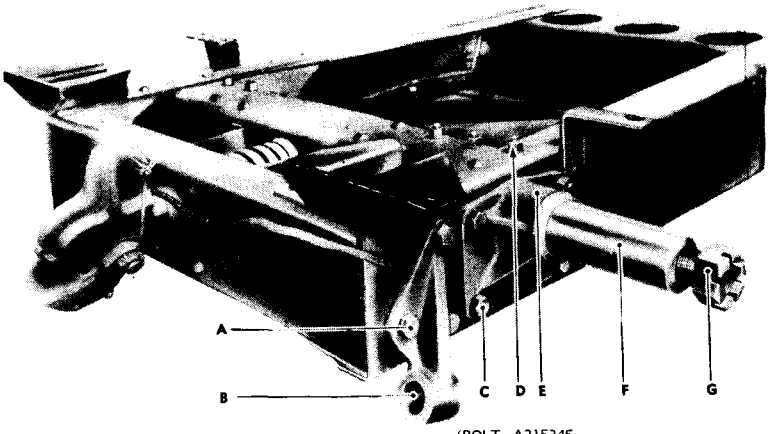
Hammer, brass Wrench, socket, $1\frac{7}{16}$-in.

Drive anchor pin into adjusting rod end, and draw it up tight with stop nut. Slip anchor pin into tapered hole at bottom of shackle, and apply nut loosely. Thread inner bronze nut well onto adjusting rod, slide outer end of rod through bracket hole, and thread outer bronze nut onto rod (fig. 23). Tighten anchor pin nut.

(4) REPLACE IDLER BEARINGS.

Hammer Tool, bearing driving (fig. 52) or brass drift

Drive inner and outer bearings into idler. If bearing driving tool is not available, use brass drift. NOTE: Do not drive inner bearing seal into idler.



A — BOLT - A215344, NUT - BBBX2B, WASHER, LOCK - BECX1P

B — BRACKET - C86023

C — BOLT - A215335, BOLT - A215331, NUT - BBBX2B, WASHER, LOCK - BECX1P

D — BOLT - A215345, BOLT - A215592, NUT - BBBX1E, WASHER, LOCK - BECX1M

E — BRACKET - C86022

F — POST - C86201

G — NUT - A215329, WASHER - A215332, PIN, COTTER - BFAX2CF

RA PD 7474

Figure 50—Track Adjusting Idler Post—Installed

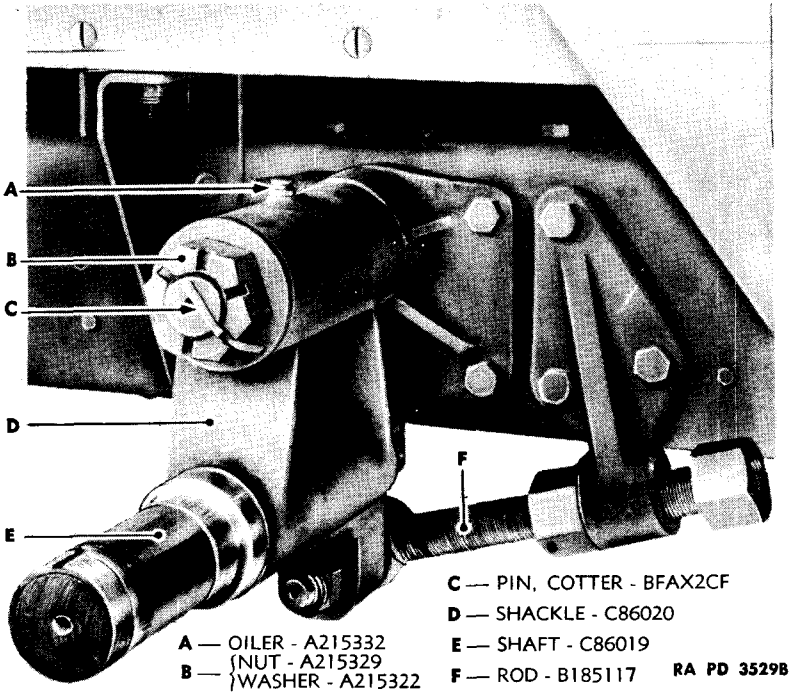


Figure 51—Track Adjusting Idler Shaft and Bracket—Installed

(5) ASSEMBLE IDLER TO SHAFT.

Block, wooden
Hammer, sledge
Screwdriver
Wrench, spanner, bearing nut, special

Push inner bearing seal onto raised shoulder of shaft. Start idler onto shaft, and drive it the remainder of the distance. Replace bearing lock washer and nut; bend washer prongs to lock assembly in place.

(6) REPLACE HUB COVER.

Wrench, socket, $\frac{7}{16}$-in.

Set hub cover on studs and draw up tight with stud nuts.

d. Top (supporting) Roller (fig. 21).

Hammer
Hammer, soft metal
Tool, bearing driving
Tool, seal driving

(1) REPLACE BEARING AND SEALS.

Hammer
Tool, bearing driving
Tool, seal driving

Inspect spacer; then drive bearings and seals into roller hubs.

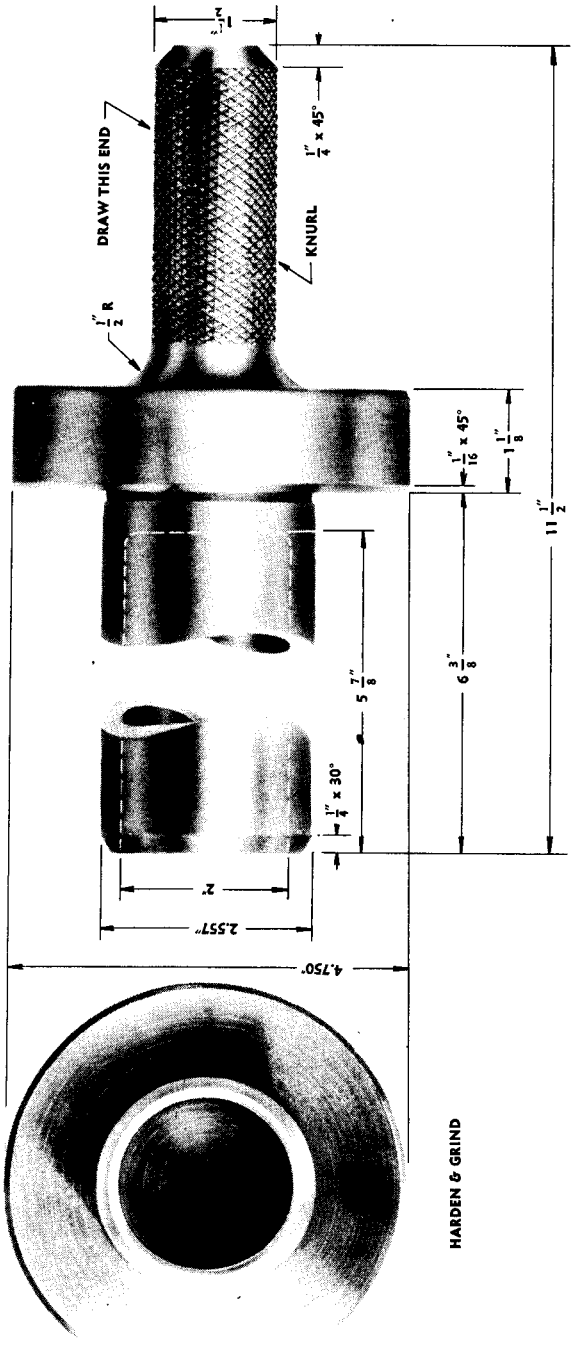


Figure 52—Track Adjusting Idler Bearing Driving Tool

(2) INSTALL END BRACKETS.

Hammer

Tap end bracket assemblies into hubs.

(3) REPLACE ROLLER GUDGEON BOLT.

Hammer, soft metal

Tap gudgeon bolt lightly, forcing it through brackets and bearings, and replace nut. Threaded end must be inserted first through bracket with rectangular opening.

19. INSTALLATION OF ASSEMBLY.

a. Bogie.

Chain and hook assembly, spring holding	Wrench, socket, $1\frac{5}{8}$-in.
Jack	Wrench, socket, $1\frac{1}{16}$-in.
Wrench, box, $\frac{3}{4}$-in.	Wrench, socket, $1\frac{1}{8}$-in.
Wrench, box, $1\frac{5}{8}$-in.	Wrench, square socket, $\frac{5}{8}$-in.

(1) ASSEMBLE BOGIE TO CAR.

Jack	Wrench, socket, $1\frac{1}{16}$-in.
Wrench, socket, $1\frac{5}{8}$-in.	Wrench, socket, $1\frac{1}{8}$-in.

Lift bogie assembly and force it onto cross tube. Bolt bogie to cross tube and replace eight bolts, lock washers, and nuts attaching it to frame.

(2) REMOVE SPRING COMPRESSING BOLTS AND NUTS.

Chain, spring holding	Wrench, square socket, $\frac{5}{8}$-in.
Wrench, box, $1\frac{5}{8}$-in.	

Attach spring holding chain to bogie roller frame shafts as explained in paragraph 15 a (1). Turn compressing screw nuts, alternately, thus releasing springs until the entire downward thrust is supported by the chain and all tension is removed from the screws. Turn screws out of spring block and remove from bracket.

(3) REPLACE TOP (SUPPORTING) ROLLER.

Wrench, box, $\frac{3}{4}$-in.

Bolt top roller and brackets to top of bogie frame bracket.

(4) REPLACE TRACK. See paragraph 19 c below.

b. Adjusting Idler.

Bar, driving	Pliers
Hammer, sledge, light	Wrench, socket, $2\frac{1}{2}$-in.

(1) ATTACH IDLER TO FRAME.

Bar, driving	Pliers
Hammer, sledge, light	Wrench, socket, $2\frac{1}{2}$-in.

Drive idler post into brackets carrying with it the idler assembly. Replace idler post inner nut and cotter pin.

(2) REPLACE ADJUSTING ROD BRONZE NUT. Pull idler shackle back so that adjusting rod passes through bracket and start outer bronze nut onto rod.

(3) REPLACE TRACK. See paragraph 19 c below.

c. Track.

Lumber, 2 x 4 in., 4-ft lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two
Wrench, open-end, 2-in.
Wrench, socket, 3/4-in.
Wrench, socket, $1\frac{7}{16}$-in.

(1) SET TRACK IN POSITION FOR REPLACING.

Lumber, 2 x 4 in., 4-ft lengths, two
Lumber, 2 x 4 in., 6-ft lengths, two

Place two 6-foot lengths of 2 x 4's between car body and frame. Lift track onto lumber and block up with 4-foot lengths of 2 x 4's (fig. 27).

(2) REPLACE TRACK.

Bar, pinch

Set track on sprocket first, then onto top roller and under bogie rollers, and, finally, onto adjusting idler. Use pinch bar, if necessary, to set it on idler. The track should be positioned on the vehicle so that the widest spaced guide vanes of the guides on the bottom part of the track are pointed toward the front of the vehicle.

(3) REPLACE IDLER FLANGE.

Wrench, socket, 3/4-in.

Place flange on idler studs, and tighten in position with stud lock washers and nuts.

(4) LOWER REAR OF CAR ONTO TRACK.

Wrench, open-end, 2-in.

Pull back adjusting idler by turning adjusting rod upper nut until slack is taken out of track. Lower jack until weight of car rests on bogie rollers, and remove jack and spring holding chain.

(5) ADJUST TRACK TENSION.

Wrench, open-end, 2-in.
Wrench, socket, $1\frac{7}{16}$-in.

For correct adjustment of track, preload vehicle to its maximum payload capacity. Then pull back adjusting idler, by turning adjusting rod upper nut, until there is 3/4-inch sag in the track between top roller and idler when an average weight man is standing upon it. Idler should be locked in this position by tightening adjusting rod lower nut and also the anchor pin nuts.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section VI

BRAKE SYSTEMS

	Paragraph
General description	20
Trouble shooting	21
Service brake pedal linkage	22
Master cylinder	23
Vacuum power booster	24
Booster air cleaner and check valve	25
Service brake lines	26
Wheel brakes	27
Drive shaft brake	28
Trailer brake controller	29

20. GENERAL DESCRIPTION (fig. 53).

a. Construction. Actuation of the service brakes on the front wheels and jackshaft driving sprockets is controlled by a hydraulic system which is comprised of: pedal and linkage, a master cylinder, a vacuum power booster, an air cleaner and check valve for the booster, brake lines, wheel cylinders and shoes. The master cylinder piston and vacuum booster piston are directly connected to the pedal linkage and are located directly behind the linkage. The booster check valve is attached to the dash on the engine side and is connected by tubing to the rear of the booster. The air cleaner is attached to the voltage regulator bracket on the engine side of the dash and is connected by tubing to the front end of the booster. The brake lines connect the master cylinder to each of the four wheel cylinders. The wheel cylinders and brake shoes are enclosed by the brake drums. A disk type mechanical brake used only for parking is mounted on a companion flange of the rear propeller shaft. An electric brake controller is provided to control the brakes on a towed load. The controller is directly connected to the brake pedal by means of a rod linkage.

NOTE: In later production vehicles, a Hydrovac unit is being used in place of the vacuum booster. This substitution eliminates most of the brake linkage leading from the pedal to the master cylinder and to the booster and increases the braking force available to the operator of the vehicle. (See TB 1710C-2.)

b. Operation. Pressure exerted on the brake pedal is transmitted by the linkage to the master cylinder. This pressure forces fluid out of the cylinder into the lines and thence to the four wheel cylinders. The wheel cylinder pistons are forced outward, thereby bringing the brake shoes in contact with the brake drums. The vacuum power unit starts to operate shortly after the pedal linkage begins to move and acts as a power or booster complement for the brake pedal to reduce the amount of physical effort required to apply the brakes.

21. TROUBLE SHOOTING.

Symptom and probable cause	Probable remedy
a. Pedal Striking Floor Board.	
Linings worn.	Readjust upper ends of shoes only.
Incorrectly adjusted brake shoes.	Readjust shoes at both ends.
Improperly adjusted pedal.	Readjust pedal linkage.
Leak in system.	Check system and repair.
Air in system (indicated by spongy pedal action).	Bleed lines.
Insufficient brake fluid.	Refill master cylinder.
b. All Brakes Drag.	
Insufficient brake shoe clearance.	Readjust shoes.
Mineral oil in system.	Flush system with alcohol, and replace cylinder cups.
Improper pedal adjustment.	Readjust pedal and linkage.
Weak pedal return spring.	Replace spring.
c. One Brake Drags.	
Weakened or damaged brake shoe return spring.	Replace spring.
Shoe binding on anchor pin.	Free and lubricate pin.
Insufficient brake shoe clearance.	Readjust shoes.
Loose wheel bearings.	Readjust bearings to position drum correctly around brake shoes.
Grease on linings.	Replace linings.
Tubing obstructed.	Replace tubing.

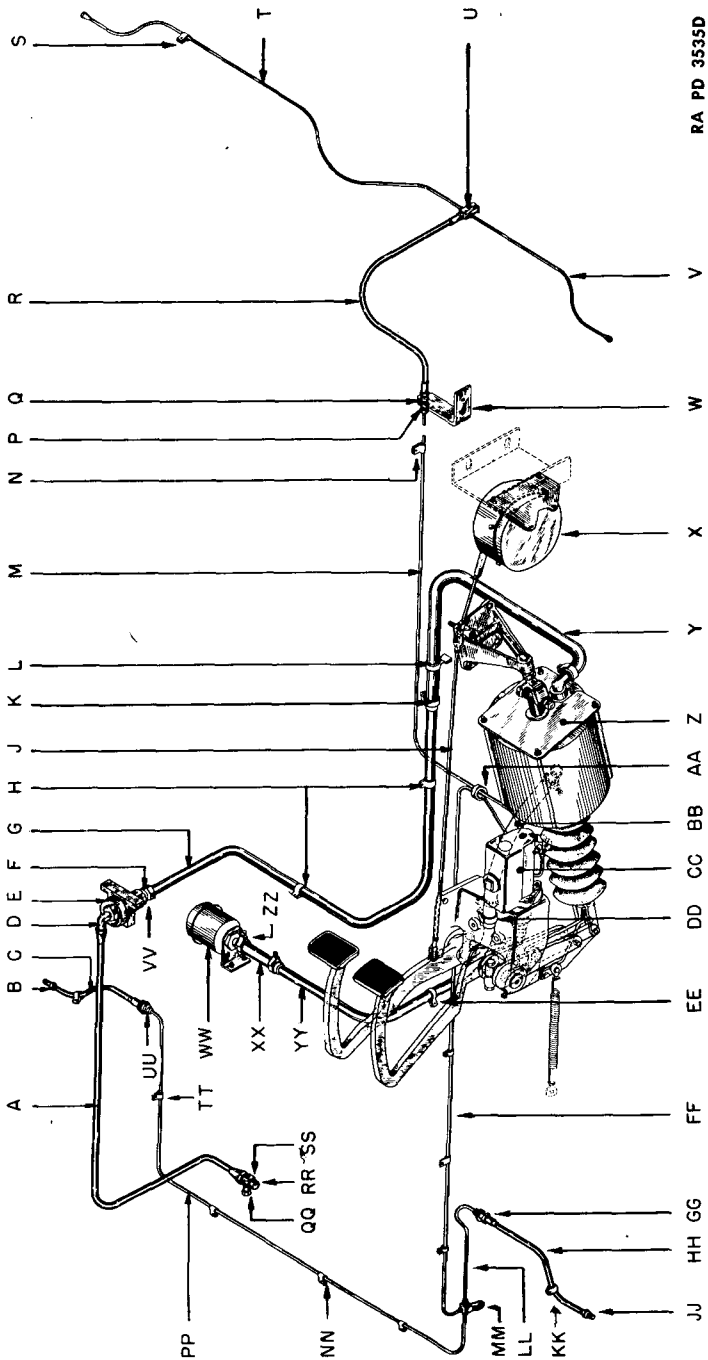


Figure 53A—Hydraulic Brake System—Schematic

A — LINE, ASS'Y - C85562

B — GASKET - A214930

C — HOSE, ASS'Y - B184318

D — ELBOW - A167665

E — VALVE, ASS'Y - A167374

F — FITTING - A214474

G — LINE, ASS'Y - C85563

H — CLIP - A214920

J — ROD - A214430

K — CLAMP - A214536

L — CLIP - A214919

M — LINE, ASS'Y - D48219

N — CLIP - A225850

P — UNION - A167680

Q — NUT - A214351

R — HOSE - A186757

S — CLIP - A214906

T — LINE, ASS'Y - D48220

U — TEE - A167679

V — LINE, ASS'Y - C85778

W — BRACKET - B184299

X — CONTROLLER, ASS'Y - D48149

Y — HOSE - A214911

Z — CYLINDER, ASS'Y - A214508

AA — GROMMET - A214899

BB — HOSE - A214912

CC — CYLINDER, ASS'Y - C85588

DD — CLAMP - A214536

EE — CLIP - A214910

FF — LINE, ASS'Y - D48218

GG — NUT - A214351

HH — HOSE, ASS'Y - B184318

JJ — GASKET - 214930

KK — CLIP - A216300

LL — LINE, ASS'Y - C85777

MM — TEE - A167681

NN — CLIP - A186529

PP — LINE, ASS'Y - C85776

QQ — NUT - A225932

RR — CONNECTOR - A186773

SS — PLUG - A167643

TT — CLIP - A186529

UU — NUT - A214351

VV — PLUG - A167643

WW — CLEANER, ASS'Y - B184194

XX — HOSE - A214907

YY — LINE, ASSEMBLY - C85563

ZZ —CLAMP - A214536

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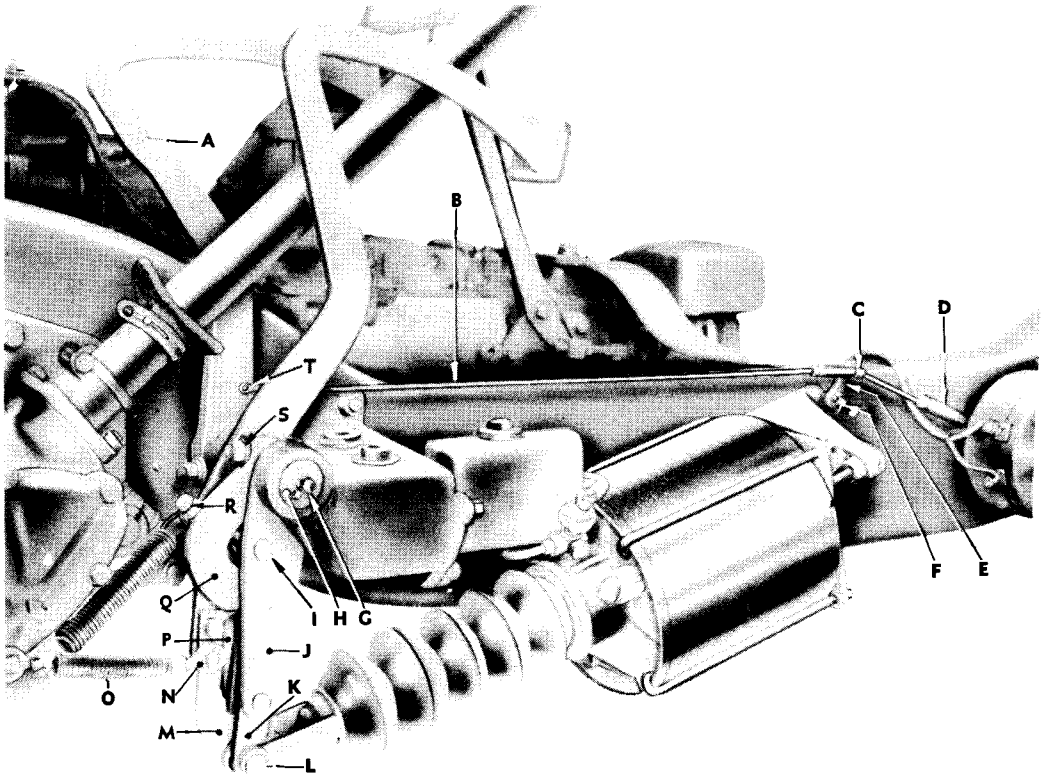
Figure 53B—Hydraulic Brake System—Nomenclature

Symptom and probable cause	Probable remedy
d. Pulling to One Side.	
Grease on linings.	Replace with new linings of the same type.
Shoes improperly adjusted.	Readjust and check with feeler gage.
Loose backing plate.	Tighten plate and readjust brake shoes
Different linings.	Replace those differing with linings of the same make.
Worn linings.	Replace with new linings.
Scored drums.	Resurface or replace.
e. Excessive Pressure on Pedal, Poor Stops.	
Brake shoes incorrectly adjusted.	Readjust shoes.
Improper linings.	Replace with proper linings.
Partial contact between lining.	Dress down high spots on linings and adjust shoes at their ends.
f. Light Pressure on Pedal, Severe Brakes.	
Brake shoes incorrectly adjusted.	Readjust shoes.
Improper linings.	Replace with proper linings.
Partial contact between lining and drum.	Dress down high spots on linings, and adjust shoes at their ends.
g. Noisy Brakes.	
Bent or distorted backing plate.	Straighten or replace with new plate.
Bent or distorted brake shoes.	Replace with new shoes.
Dirt in linings.	Remove any imbedded particles.
Loose lining rivets.	Replace loose rivets.
Drums distorted.	Replace or have reground.

22. SERVICE BRAKE PEDAL LINKAGE.

a. Description (figs. 54 and 55).

The brake pedal linkage is installed in the vehicle on the outer left side of the frame, directly behind the steering gear assembly.



A — {PEDAL - C85509
KEY, WOODRUFF - BGAX15A}
B — ROD - A214430
C — {PIN - A214432
PIN, COTTER - BFAX1CE}
D — OVERTRAVEL, ASS'Y - B184406
E — LEVER - A214316
F — {STUD - A214328
NUT - BBBX1D
WASHER, LOCK - BECX1L
WASHER - BEBX1CK
PIN, COTTER - BFAX1CF}
G — FITTING - CLDX5M
H — SHAFT - B184112
I — PIN, CLEVIS - A214303
J — LEVER - B184110
K — LEVER - A214302
L — {PIN, CLEVIS - A214523
PIN, COTTER - BFAX1CE}
M — FORK - B184109
N — {SCREW, CAP - BCAX1BB
WASHER, LOCK - BECXIH
WASHER - A214909}
O — SPRING - B184320
P — LEVER - B184111
Q — {LEVER - B184108
KEY, WOODRUFF - BGAX15A}
R — {SCREW - A214330
NUT - BBAX1B}
S — {SCREW, CAP - BCBX1DK
NUT - BBBX1D
WASHER, LOCK - BECX1L}
T — {PIN - BFFX1B
PIN, COTTER - BFAX1CE}

RA PD 56188

Figure 54—Brake Pedal Linkage—Installed

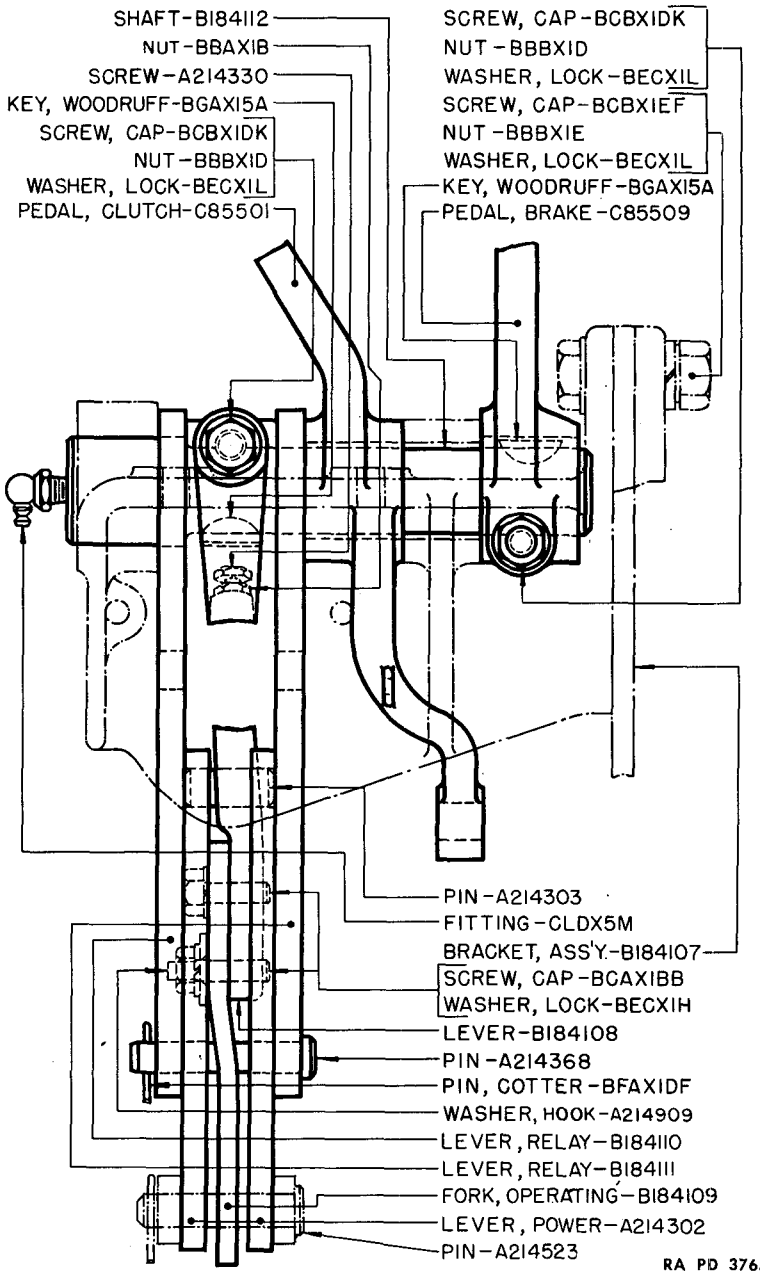


Figure 55—Brake Pedal Linkage—Sectionalized

BRAKE SYSTEMS

(1) CONSTRUCTION.

(a) The brake linkage is mounted on the clutch and brake pedal shaft which turns in bronze bushings in the brake pedal support bracket. The shaft is provided with cross grooves and keyways near both ends to engage binder bolts and keys to mount the brake and clutch pedals. Mounted on the pedal shaft are the inner and outer master cylinder relay levers, the master cylinder operating lever which is locked to the shaft by its binder bolt and to which is attached the vacuum booster operating fork, the clutch pedal which is free on the shaft, and the brake pedal which is locked to the shaft by its binder bolt.

(b) Two power levers, to which the vacuum booster yoke is pinned, are mounted between and are pin-connected to the master cylinder relay levers on the bottom, and to the master cylinder operating lever at the top. The top pin passes through the power levers and the master cylinder operating lever, and is kept in position by the master cylinder relay levers which are mounted on either side.

(2) OPERATION. Depressing the brake pedal causes the pedal shaft to rotate, thereby rotating the master cylinder operating lever toward the rear. The vacuum booster valve operating fork, attached to the master cylinder operating lever, is moved toward the rear and pushes the booster valve rod in. Approximately $\frac{3}{16}$ inch motion of the valve rod is required before the vacuum booster begins to operate and pull the two power levers toward the rear. Approximately $\frac{3}{8}$ inch motion of the valve rod is sufficient to take up the play between the master cylinder operating lever adjusting screw and the master cylinder yoke rod end pin which connects the master cylinder to the relay levers. Continuation of the pedal depression and the vacuum booster pulling action causes the entire brake linkage assembly to rotate toward the rear and operates the master cylinder and the entire hydraulic brake system.

b. Removal of Assembly.

Pliers	Wrench, open-end, $\frac{9}{16}$-in.
Screwdriver	Wrench, open-end, $\frac{7}{8}$-in.

(1) REMOVE DRIVER'S SEAT FLOOR PLATE.
Screwdriver

Remove ten machine screws, nuts, and lock washers from aluminum floor plate and remove plate.

(2) REMOVE FOOT DIMMER SWITCH.
Screwdriver.

Remove two machine screws and lock washers holding foot dimmer switch assembly to toeboard and remove switch.

(3) REMOVE THROTTLE CONTROL SHAFT BRACKET.
Wrench, open-end, $\frac{9}{16}$-in.

Remove two bolts and lock washers holding left throttle control bracket to toeboard and remove bracket.

(4) REMOVE TOEBOARD.
Wrench, open-end, $\frac{9}{16}$-in.

Remove remaining 18 lower toeboard bolts, nuts, and lock washers. Toeboard now may be lifted off dimmer switch and off throttle control bellcrank.

(5) DISCONNECT MASTER CYLINDER.
Pliers
Wrench, open-end, $\frac{9}{16}$-in.

Remove cotter pin and rod end pin holding master cylinder rod end yoke to relay levers. Reach up under brake pedal bracket, pry strap and boot off cylinder lip, and remove boot and push rod assembly. Remove three bolts and lock washers holding master cylinder to bracket.

(6) DETACH CLUTCH. Unhook clutch pedal pull back spring from clutch relay arm. Unhook brake pedal pull back spring from hook washer on power cylinder fork.

(7) DETACH CLUTCH RELAY SHAFT LEVER YOKE.
Pliers

Unhook yoke from clutch pedal by removing cotter pin and rod end pin.

(8) DETACH VACUUM BOOSTER VALVE LINK AND PISTON ROD YOKE END.
Pliers.

Remove cotter pin and rod end pin holding link and yoke end to power levers. Drop link and push back booster yoke.

(9) REMOVE CLUTCH AND BRAKE PEDAL BRACKET.
Wrench, open-end, $\frac{7}{8}$-in.

Jack up engine under fly-wheel housing. The same bolts that hold pedal bracket to frame, support the engine rear support bracket which will be released when pedal bracket bolts are removed. Remove clutch and brake pedal bracket by removing four nuts, lock washers, and bolts holding bracket to frame.

c. Disassembly.
Drift, brass
Hammer
Pliers
Press
Wrench, open-end, $\frac{7}{16}$-in.

(1) REMOVE CLUTCH AND BRAKE PEDAL SHAFT.
Wrench, open-end, $\frac{7}{16}$-in.

Remove nut and lock washer on brake pedal binder bolt and master cylinder lever binder bolt, and remove bolts. Pull clutch and brake pedal shaft out of bracket from outer end. This will remove the following: brake pedal, clutch pedal, inner relay lever, master cylinder operating lever, and outer relay lever.

(2) REMOVE LUBRICATING FITTING.

Pliers

Screw out lubricating fitting.

(3) REMOVE INNER AND OUTER RELAY LEVERS.

Pliers

Remove cotter pin and rod end pin, and remove relay levers from both sides of operating lever.

(4) REMOVE POWER LEVERS.

Drift, brass Hammer

Push pin out of power levers and operating levers, and remove levers.

(5) REMOVE VACUUM BOOSTER OPERATING FORK.

Wrench, open-end, $\frac{7}{16}$-in.

Remove two cap screws, lock washers, and hook washer, and remove operating fork from master cylinder operating lever.

(6) REMOVE BUSHINGS FROM BRACKET.

Drift, brass Press

Hammer

If inspection shows replacement necessary, try tapping old bushings out while tapping new ones in. If frozen, drive or press out.

d. Maintenance and Adjustment.

(1) Keep linkage well lubricated, and be sure that the system is clean and in correct alinement with no binding on the levers or shaft.

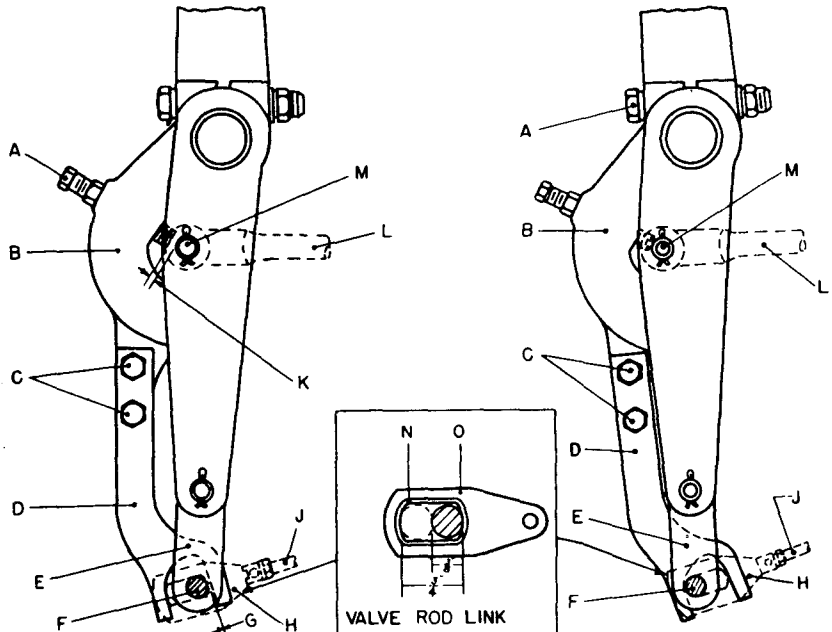
(2) ADJUSTMENT (fig. 56).

(a) Loosen booster valve operating fork mounting screws. Remove master cylinder and booster yoke rod end pins. Block brake pedal in release position.

(b) Adjust master cylinder yoke to permit approximately $\frac{1}{32}$ inch lost motion in master cylinder piston rod. Replace master cylinder yoke rod end pin.

(c) Pull vacuum booster piston rod out until piston bottoms. Aline piston rod yoke with power lever holes by turning booster rear mounting yoke in the frame mounting bracket.

(d) Replace booster yoke rod end pin, and check to see that the pin is against the rear sides of the booster valve rod link holes with $\frac{7}{64}$ inch clearance between the master cylinder operating lever adjusting screw



1 - VALVE OPERATING FORK AND LINK IN CLOSED POSITION

2 - VALVE OPERATING FORK AND LINK IN OPEN POSITION

A - ADJUSTING SET SCREW, W/NUT
B - BRAKE PEDESTAL EXTENTION LEVER
C - VALVE OPERATING FORK ANCHOR SCREW (2)
D - VALVE OPERATING FORK
E - POWER LEVER
F - POWER CYLINDER PISTON CLEVIS PIN
G - CLEARANCE FOR PIN AND VALVE LINK BUSHING SIDE WALL
H - VALVE ROD LINK W/BUSHING
J - POWER CYLINDER VALVE ROD
K - CLEARANCE FOR SET SCREW AND PIN
L - MASTER CYLINDER PISTON CLEVIS PIN
M - MASTER CYLINDER PISTON ROD CLEVIS PIN
N - PISTON ROD LINK
O - PISTON ROD LINK BUSHING

RA PD 3537

Figure 56—Brake Pedal Linkage—Adjustment

A — BOLT - BAOX1DK
NUT - BBBX1D
WASHER, LOCK - BECX1L
B — SCREW - A214330
C — LEVER - B184108
D — PIN - A214303
E — SCREW, CAP - BCAX1BB
F — WASHER, HOOK - A214909
G — LEVER - B184110
H — FORK - B184109
J — LINK - A214520
K — PIN - A214523
L — END, YOKE - A214526
M — LEVER - A214302
N — PIN - A214368
P — LEVER - B184111
Q — PEDAL, CLUTCH - C85501

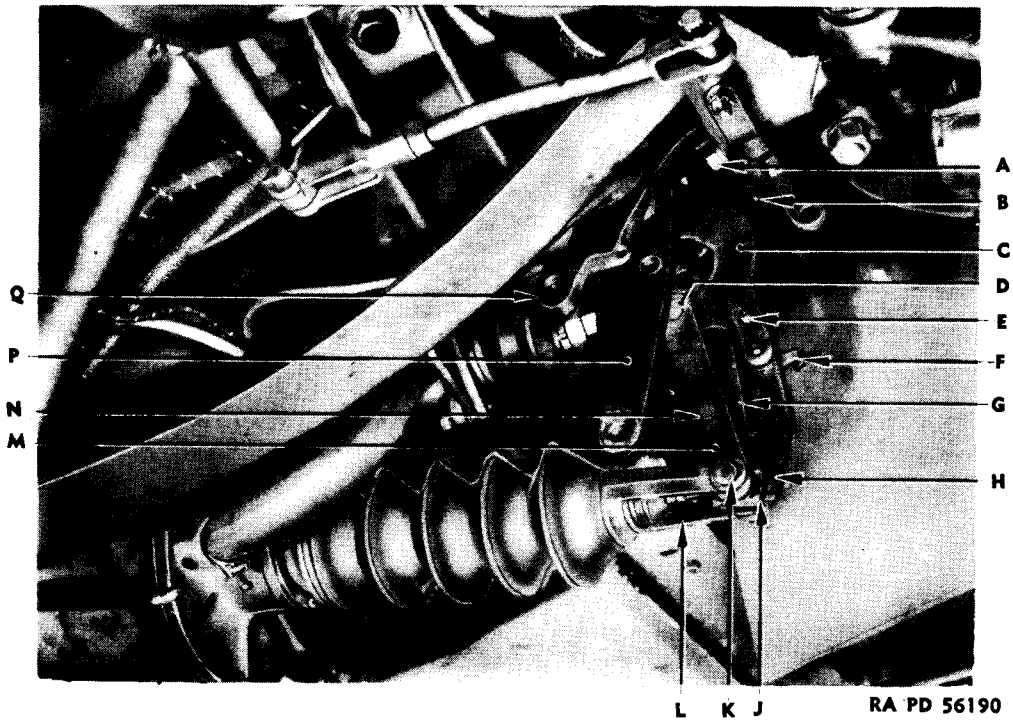


Figure 57—Brake Pedal Linkage—Partially Disassembled

and the master cylinder yoke rod end pin. Tighten the two booster valve fork mounting screws being careful not to disturb position of valve.

(e) Check for proper clearance of master cylinder operating lever adjusting screw and rod end pin to obtain approximately 3/8 inch travel of the booster valve fork before the clearance is taken up.

(f) With the engine not running and the brake pedal moved by hand, all clearance at the adjusting screw and master cylinder yoke rod end pin should be taken up when the booster valve rod moves inward about 3/8 inch.

(g) With the engine running, the booster valve rod should move in approximately 3/16 inch before any movement of the booster piston rod occurs.

(h) Check all links and levers for loose bolts and be sure that all cotter pins are replaced.

e. Reassembly (fig. 57).

Pliers
Wrench, open-end, 7/16-in.
Wrench, open-end, 7/8-in.

(1) REASSEMBLE UNITS ON PEDAL SHAFT.

Pliers
Wrench, open-end, 7/16-in.

With bushings and keys in place, pass small end of shaft through large bushing, outer relay lever, master cylinder operating fork lever, inner relay lever, clutch pedal, small bracket bushing, and brake pedal. Replace binder bolts in brake pedal and operating fork lever, seating bolts in grooves on shafts. Replace lock washers and nuts. Replace lubrication fitting.

(2) REPLACE POWER LEVERS. Push master cylinder relay lever arms back to expose hole in knee of master cylinder operating fork lever. Put in retaining pin and hang power levers on each end. Pull master cylinder relay levers forward. Replace relay lever to power lever retaining rod end pin and cotter pin.

(3) REPLACE POWER CYLINDER OPERATING FORK.

Wrench, open-end, 7/16-in.

Place lock washers on both cap screws and hook washer on lower cap screw and replace screws. Set up lightly prior to adjusting.

f. Installation.

Pliers
Screwdriver
Wrench, open-end, 7/16-in.
Wrench, open-end, 9/16-in.
Wrench, open-end, 7/8-in.

BRAKE SYSTEMS

(1) REPLACE CLUTCH AND BRAKE PEDAL LINKAGE ASSEMBLY.
Wrench, open-end, 7/8-in.

Line up four holes in pedal bracket flange with holes in frame and engine rear support bracket. Replace four bolts, nuts, and lock washers. Remove jack from under flywheel housing.

(2) INSTALL MASTER CYLINDER ASSEMBLY. Insert lip of master cylinder through large bracket hole. Line up three cylinder flange holes with bracket bolt holes, and replace three bolts and lock washers. Replace push rod assembly, snap boot on cylinder lip, and replace steel strap over boot.

(3) CONNECT MASTER CYLINDER TO LINKAGE.
Pliers

Line up master cylinder yoke with clevis holes in arms of relay levers and insert rod end pin and cotter pin.

(4) CONNECT BOOSTER VALVE LINK AND PISTON ROD END YOKE TO LINKAGE.
Pliers Wrench, open-end, 7/16-in.

Line up hole in valve link and eyes of booster piston rod yoke end with clevis hole of power lever. Insert rod end pin and cotter pin. Loosen cap screws on booster valve operating fork, place forked end over booster valve link, and tighten cap screws.

(5) CONNECT CLUTCH RELAY SHAFT LEVER YOKE. Line up yoke eyes with clevis hole in clutch pedal, and replace rod end pin and cotter pin.

(6) REPLACE CLUTCH AND BRAKE PEDAL PULLBACK SPRINGS.
Pliers

Replace springs in lock washers and holes in linkage.

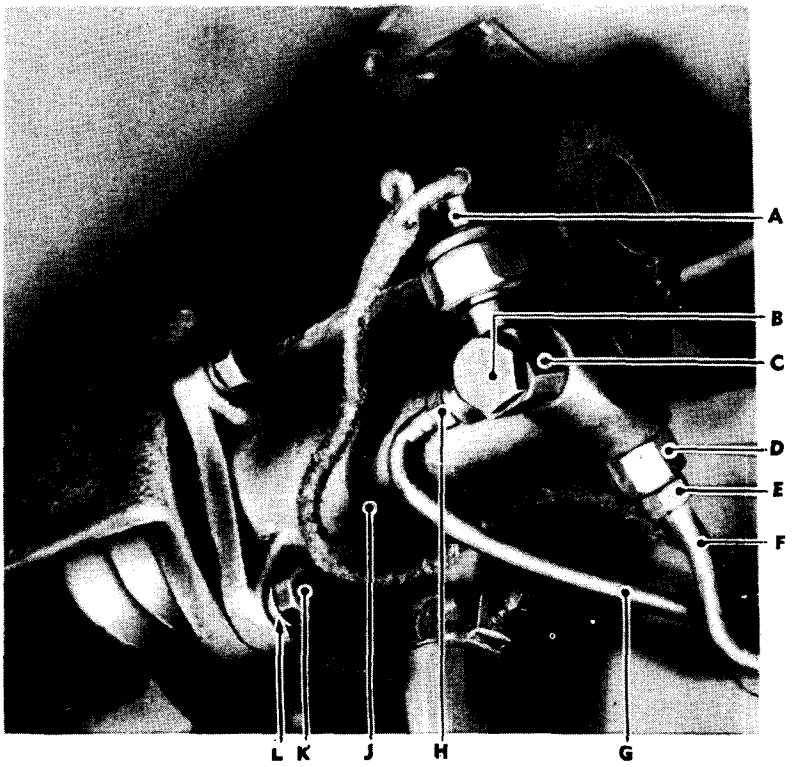
(7) ADJUST LINKAGE. See paragraph 22 d.

(8) REPLACE LOWER TOEBOARD.
Screwdriver Wrench, open-end, 9/16-in.

Seat toeboard so that foot dimmer switch and accelerator bellcrank protrude through holes provided. Replace two screws and lock washers attaching foot dimmer switch. Replace two bolts, nuts and lock washers attaching accelerator bellcrank bracket. Insert 18 toeboard bolts, nuts, and lock washers.

(9) REPLACE FLOOR PLATE UNDER DRIVER'S SEAT.
Screwdriver

Replace floor plate and 10 machine screws, nuts and lock washers.



A— SWITCH - A167682
B — {BOLT - A167419
{GASKET - A160323
C — {FITTING - A214537
{GASKET - A214539
D — {FITTING - A186963
{GASKET - A214538
E — NUT - A167154
F — LINE, ASS'Y - D48219
G — LINE, ASS'Y - D48218
H — NUT - A167154
J — CYLINDER, ASS'Y - C85588
K — BOLT - BANX1CD
L — WASHER, LOCK - BECX1K

RA PD 56189

Figure 58—Master Cylinder—Installed

23. MASTER CYLINDER.

a. Description (fig. 58). The master cylinder is a Wagner Electric combination-type unit with the reservoir or supply tank cast integrally with the cylinder barrel.

(1) CONSTRUCTION (fig. 59).

(a) The supply tank is above the cylinder barrel and has a threaded hole on top for the combination filler and breather cap which maintains atmospheric pressure on the brake fluid at all times. An expansion plug is used to close the rear end of the tank. A bypass and intake port are provided for fluid flow between the supply tank and the cylinder barrel.

(b) On the rear left and right sides of the cylinder are two threaded holes for outlet fittings to which are attached the hydraulic brake lines leading to the front and rear wheel cylinders. A check valve, held in place by the piston return spring, is installed in the rear end of the cylinder over the outlet port. On the front end of the return spring is the primary cup and the piston. The cupped face of the primary cup is against the spring, the flat face against the rear end of the piston. The secondary cup and its retaining ring are mounted on the front end of the piston and are parts of the piston assembly. A stop washer and its lock washer are installed to the front of the piston in order to limit the piston travel on the return stroke. The piston is actuated by the push rod assembly whose rounded end sets into a recess provided in the piston and whose threaded end connects with the brake operating linkage. A rubber boot, retained by two straps, covers the push rod assembly.

(2) OPERATION.

(a) The function of the master cylinder is to displace the fluid from the central source, the supply tank, to the wheel cylinders. Besides displacing fluid, the master cylinder maintains the correct volume of fluid in the system under all temperature conditions, automatically replaces fluid lost through gravity seepage, and adds fluid, or supercharges, the system, on the return stroke of the piston after each brake application.

(b) The master cylinder push rod is connected to the brake operating lever by an adjustable yoke and rod end pin. Depressing the brake pedal applies movement to the push rod, causing the master cylinder piston to move toward the rear end of the cylinder. A very slight movement of the piston and primary cup closes the bypass port. When the port is closed, the pressure stroke starts, and as the piston travels toward the end of the cylinder, fluid is forced out through the inner part of the check valve into the outlet fittings and hydraulic lines to the wheel cylinders.

(c) When the pedal is released, the fast return of the piston and primary cup by the piston return spring and the relatively slower return of fluid from the wheel cylinders and the lines create a vacuum in the

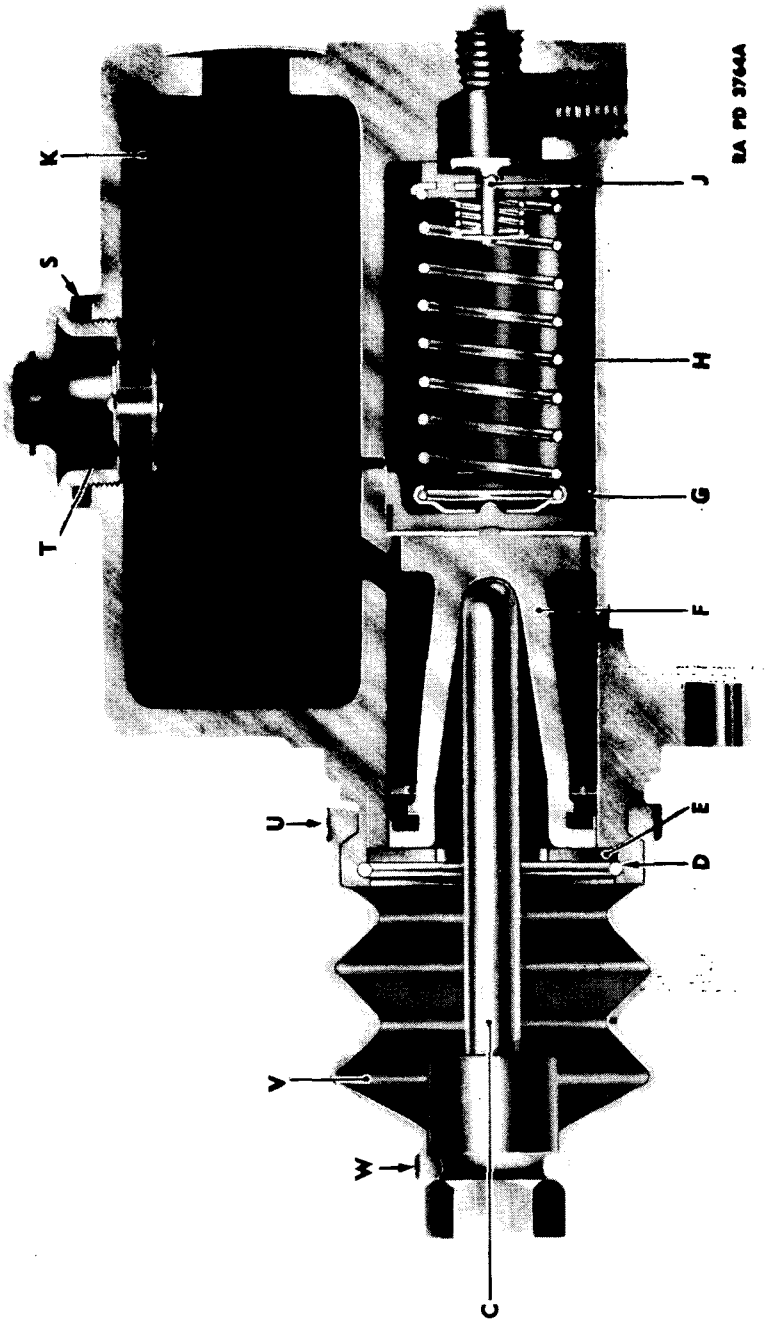


Figure 59—Master Cylinder—Sectionalized

A - YOKE - A214304
B - NUT - BBBX2A
C - ROD, ASS'Y - A214543
D - WIRE - A167878
E - WASHER - A167877
F - PISTON, ASS'Y - A214544
CUP - B184204
RING - A214545

G - CUP - B144091
H - SPRING ASS'Y - A214540
J - VALVE, ASS'Y - A214541
K - TANK - B184203
L - FITTING - A214537
GASKET - A214539
M - GASKET - A214538
N - FITTING - A186963

P - SWITCH - A167682
Q - GASKET - A160323
R - BOLT - A167419
S - GASKET - A167884
T - CAP, ASS'Y - A167888
U - STRAP - A214542
V - BOOT - A167879
W - STRAP - A167880

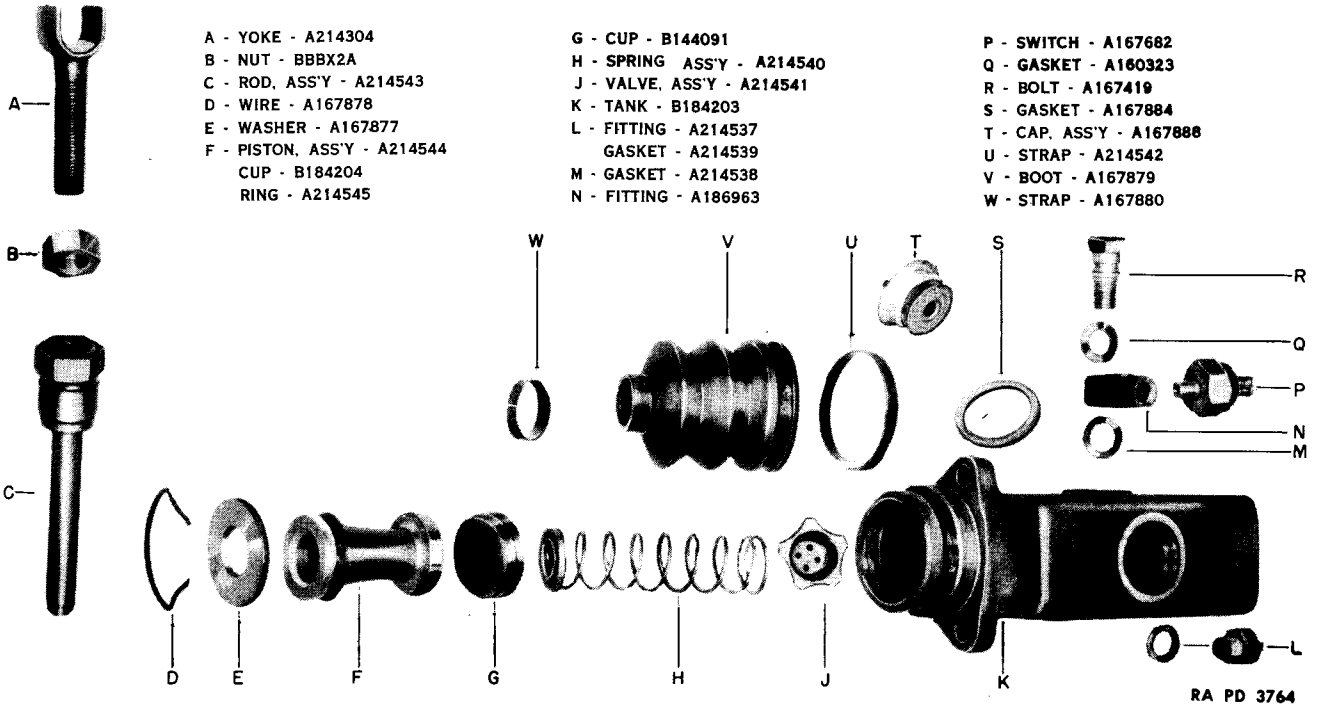


Figure 60—Master Cylinder—Exploded

cylinder barrel. This momentary vacuum pulls additional fluid from the supply tank through the piston intake port hole, past the lip of the primary cup, and supercharges the system. When the brakes are in the off position, surplus fluid can escape through the bypass port and normalize the pressure in the system. The secondary cup prevents fluid from leaking out of the master cylinder into the boot.

(d) With the piston against the stop washer, the primary cup is held against the piston by the piston return spring, and the bypass port should then be open. This port serves to prevent pressure from building up in the system because of expansion of the fluid. It also serves to permit additional fluid to enter the cylinder to prevent shortening of the pedal stroke because of contraction or loss of the fluid. This port must be open at all times when the pedal is in the release position.

(e) The function of the double check valve is to seal the cylinder to prevent air from entering the system during the bleeding operation. The construction of the valve is such that fluid may be displaced into the line at low pressure. Fluid passing into the lines as pressure is applied raises the smaller portion of the valve from its seat and permits the fluid to flow to the lines. Fluid passing into the cylinder on the return stroke can return by raising the entire valve from its seat. When pressure on the returning fluid drops to below 6 to 8 pounds, the piston return spring pressure seats the valve and the system is held under a slight pressure which serves as a seal to prevent gravity seepage. The check valve has no relation to pedal movement.

(3) SPECIFICATIONS.

Make	Wagner-Lockheed	Ordnance No.	C85588
Type	Combination	White No.	382056
Manufacturer's No.	FE-661	Diamond T No.	H1507A

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) PEDAL STRIKING FLOOR BOARD.	
Leak in cylinder.	Repair or replace housing, and check fittings.
Insufficient fluid.	Refill cylinder.
Clogged ports.	Clean.
Improper valve action.	Replace valve.
Worn primary cup.	Replace cup.
Worn piston.	Replace piston.
Air in system.	Bleed system and fill with fluid.

c. Removal of Assembly.

TOOLS:

Hammer
Pliers
Screwdriver
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.
Wrench, socket, $\frac{9}{16}$-in.

(1) DISCONNECT MASTER CYLINDER ADJUSTABLE YOKE FROM RELAY LEVERS.

Hammer
Pliers

Remove cotter pin and rod end pin holding the adjustable rod end yoke to relay levers.

(2) DISCONNECT HYDRAULIC LINES FROM MASTER CYLINDER OUTLET FITTINGS.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.

Remove flared tube nut on front wheel brake hydraulic line from outlet fitting on left side of cylinder. Remove flared tube nut on rear wheel brake hydraulic line from outlet fitting on right side of cylinder.

(3) DISCONNECT STOP LIGHT SWITCH CABLES.

Screwdriver.

Remove stop light switch wires from terminals on switch.

(4) REMOVE MASTER CYLINDER.

Wrench, socket, $\frac{9}{16}$-in.

Remove three cap screws and lock washers holding master cylinder to clutch and brake pedal bracket, and remove cylinder.

d. Disassembly (fig. 60).

Screwdriver
Wrench, open-end, ⅝-in.
Wrench, open-end, ¾-in.
Wrench, open-end, ⅞-in.
Wrench, open-end, 1-in.

(1) REMOVE STOP LIGHT SWITCH OUTLET FITTINGS AND FILLER CAP.

Wrench, open-end, ⅝-in.
Wrench, open-end, ¾-in.
Wrench, open-end, 1-in.

Remove stop light switch from front brake line outlet fitting, and gasket. Remove bolt and gasket holding fitting to cylinder and remove fitting. Remove rear brake line outlet fitting and gasket. Remove filler cap assembly and gasket.

(2) REMOVE YOKE.

Wrench, open-end, ⅞-in.

Loosen locking nut and unscrew rod end yoke from cylinder push rod.

(3) REMOVE RUBBER BOOT AND PUSH ROD ASSEMBLY.

Screwdriver

Remove small boot strap and large boot strap holding boot to push rod and cylinder, and remove boot and push rod assembly.

(4) REMOVE WORKING PARTS.

Screwdriver.

Pry out piston stop washer lock wire and remove stop washer, piston assembly with the secondary cup and ring, primary cup, piston return spring and the double check valve assembly.

e. Maintenance and Adjustments.

(1) Wash all parts in clean alcohol.

(2) Check bypass porthole and intake porthole. The holes must be clear at all times. If closed, run a wire through to clean.

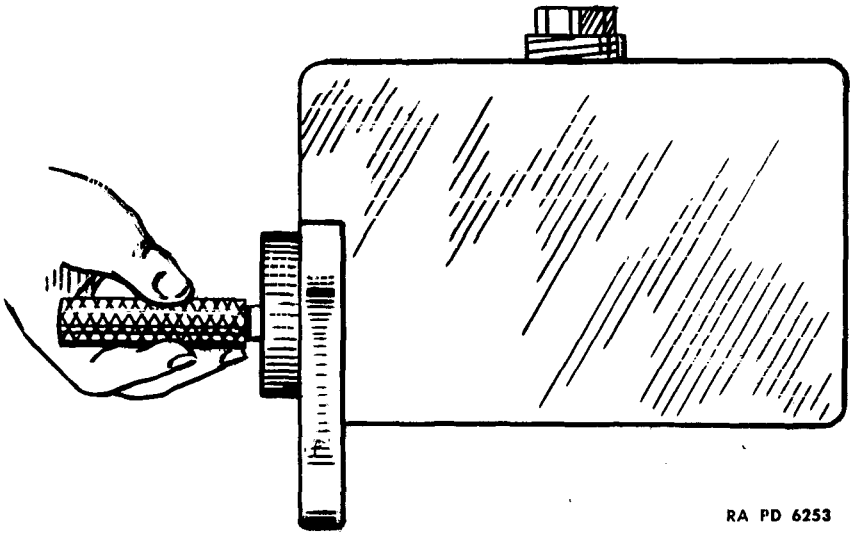


Figure 61—Master Cylinder No-Go Test

(3) Inspect primary cup outer edge, which must be smooth and clean. The outer edge may have been cut by the sharp edges of the bypass porthole. Discard a cut cup and remove sharp edges of porthole with a burring tool.

(4) Inspect cylinder bore for pitting or scratching. The walls must be smooth and may be renewed, if pitted or scratched, by honing. After honing, the diameter should be checked with a no-go gage to determine whether or not the diameter has been enlarged excessively (fig. 61).

(5) Inspect all rubber parts. If mineral oil is present in brake system, the parts will be enlarged and very soft. Replace primary and secondary cups, and check valve.

(6) Check piston fit in cylinder.

(7) Dip all parts in brake fluid before reassembly.

(8) After reassembly and installation of master cylinder in vehicle, bleed all brakes (paragraph 26 **d** (2)). Check fluid level in supply tanks. Level should be ½ to ¾ inch below filler plug.

(9) SERVICE DATA.

Brake fluid	Wagner-Lockheed No. 21
Cylinder diameter	1½-in.
Piston clearance	0.001–0.004-in.
Piston return spring pressure at $2\frac{27}{64}$ in.	12 lb

f. Reassembly (figs. 59 and 60).

Screwdriver
Wrench, open-end, ⅝-in.
Wrench, open-end, ¾-in.
Wrench, open-end, ⅞-in.
Wrench, open-end, 1-in.

(1) REPLACE WORKING PARTS.

Screwdriver

Dip all parts in brake fluid. Install check valve, piston return spring, primary cup, piston, piston stop washer, and lock wire.

(2) REPLACE BOOT AND PUSH ROD ASSEMBLY.

Screwdriver

Slip small end of boot over push rod, and set push rod into piston recess. Slip large end of boot over cylinder flange, and replace two straps on ends of boot.

(3) REPLACE YOKE.

Wrench, open-end, ⅞-in.

Screw threaded end of yoke into nut and into push rod. The number of turns to be made depends upon the length of pedal stroke required, and will be determined after installation of the master cylinder in the vehicle.

(4) REPLACE FILLER CAP, FITTINGS, AND STOP LIGHT SWITCH.

Wrench, open-end, ⅝-in.
Wrench, open-end, ¾-in.
Wrench, open-end, 1-in.

Replace filler cap and gasket in top of supply tank. Replace front brake line fitting, bolt, and gaskets on left side of cylinder. Replace stop light switch in fitting. Replace rear brake line fitting and gasket on right side of cylinder.

g. Installation of Assembly.

Pliers
Screwdriver
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.
Wrench, socket, $\frac{9}{16}$-in.

(1) REPLACE MASTER CYLINDER.

Wrench, socket, $\frac{9}{16}$-in.

Place cylinder in position and replace three cap screws and lock washers holding cylinder to brake and clutch pedal bracket.

(2) CONNECT STOP LIGHT SWITCH CABLES.

Screwdriver

Replace cables on switch terminals.

(3) CONNECT HYDRAULIC LINES TO CYLINDER.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.

Screw flared tube nuts on rear wheel brake hydraulic pipe and on front wheel brake hydraulic pipe to the fittings on the right and left sides of the cylinder, respectively.

(4) CONNECT YOKE TO RELAY LEVERS.

Pliers

Set yoke into position and replace rod end pin and cotter pin connecting yoke to relay levers.

(5) REPLACE FLUID AND BLEED BRAKES. See Bleeding the Line, paragraph 26 **d** (2).

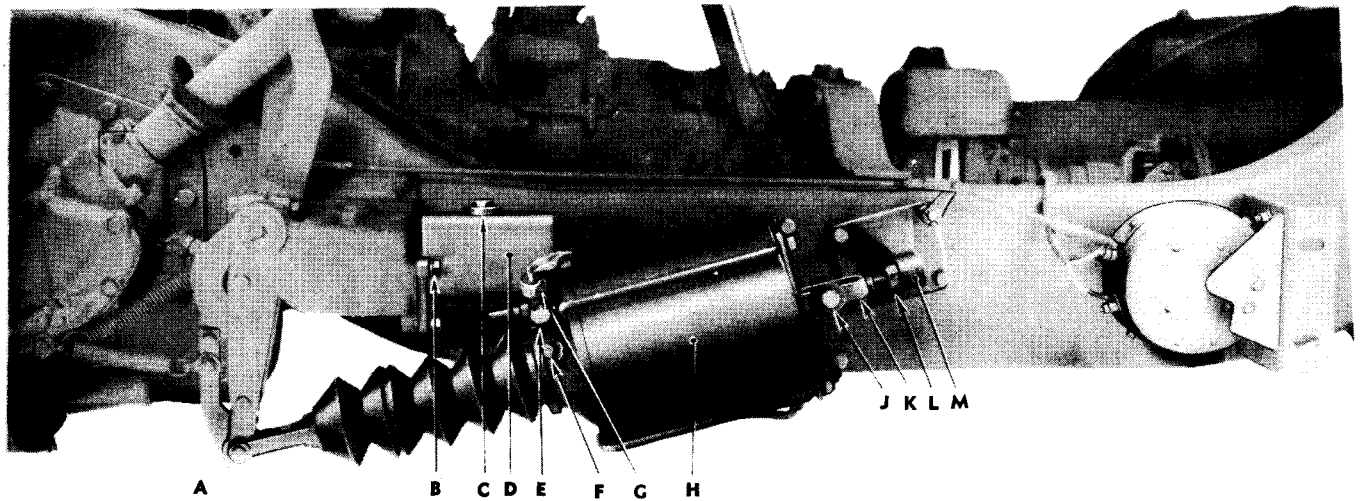
(6) ADJUST BRAKE PEDAL. See paragraph 22 **d.**

24. VACUUM POWER BOOSTER.

a. Description (fig. 62). The brake vacuum booster is a Bragg-Kliesrath, poppet valve, reactionary cylinder, puller-type unit. A reaction-type cylinder is so connected to the master cylinder and brake pedal that it supplies a maximum percentage of the power applied to the master cylinder. A definite proportion of the braking force is applied by the operator, giving him accurate control of the braking force and permits him to "feel" the brake at all times.

(1) CONSTRUCTION (fig. 63).

(a) The vacuum booster shell or housing is provided with two end plates to which are connected the vacuum and atmospheric line fittings. The vacuum line from the check valve is attached to the nipple on the rear end plate, and the atmospheric line from the air cleaner is attached to fitting on the front end plate.



A — {PIN - A214368
{PIN, COTTER - BFAX1DF
B — {BOLT - BANX1CD
{WASHER, LOCK - BECX1K
C — {CAP - A167888
{GASKET - A167884
D — CYLINDER, MASTER, ASS'Y - C85588
E — {BOLT - A167419
{GASKET - A160323
F — PLUG - A226018
G — SWITCH, ASS'Y - A167682
H — BOOSTER, VACUUM, ASS'Y - D48121
J — {PIN - BFAX1DG
{PIN, COTTER - BFAX1DH
K — ROD - B184146
L — NUT - BBBX2B
M — BRACKET - C85531

RA PD 54072

Figure 62—Vacuum Booster (Power Cylinder)—Installed

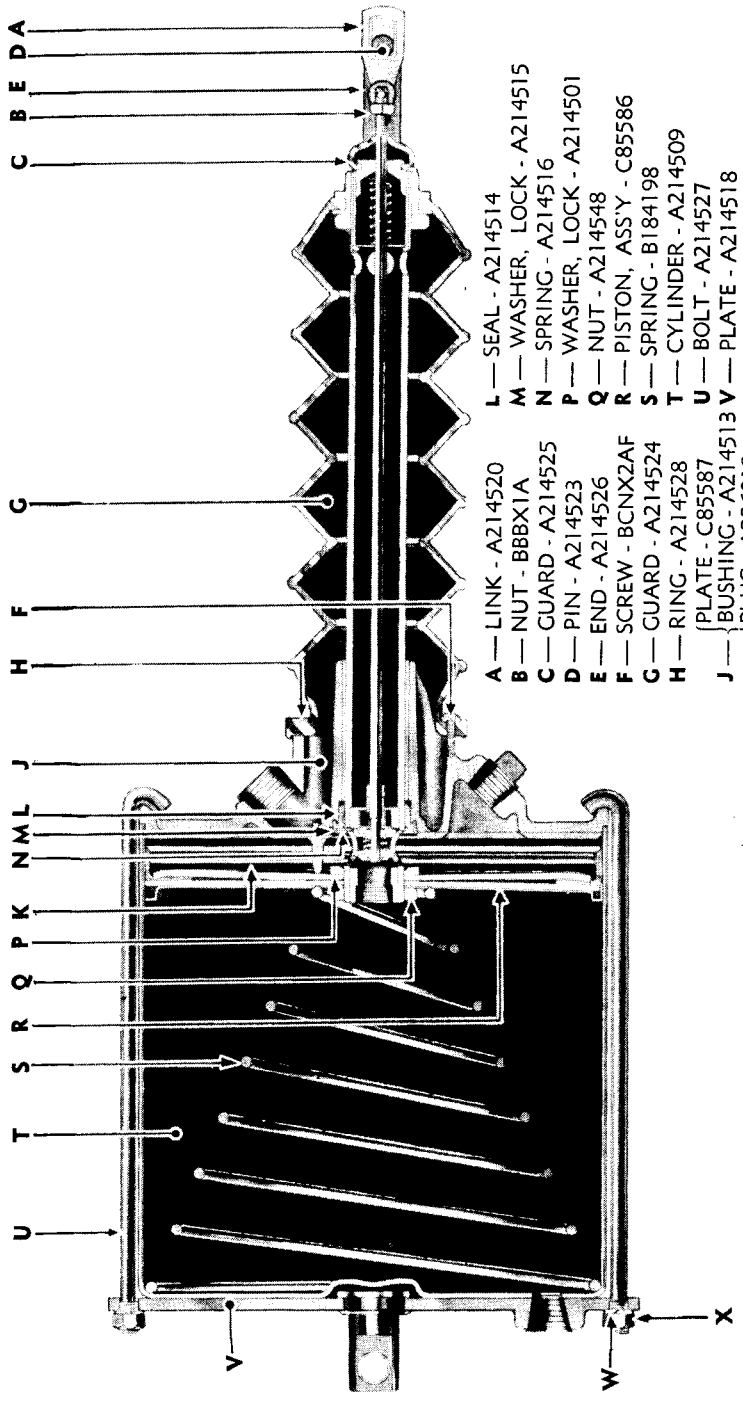


Figure 63—Vacuum Booster—Sectionalized

(b) The booster piston and rod assembly is installed in the front end of the shell and is retained in the forward position by a conical coil spring. The tubular piston rod is provided with ports on the rear and front end for passage of air and vacuum through the valve mechanism.

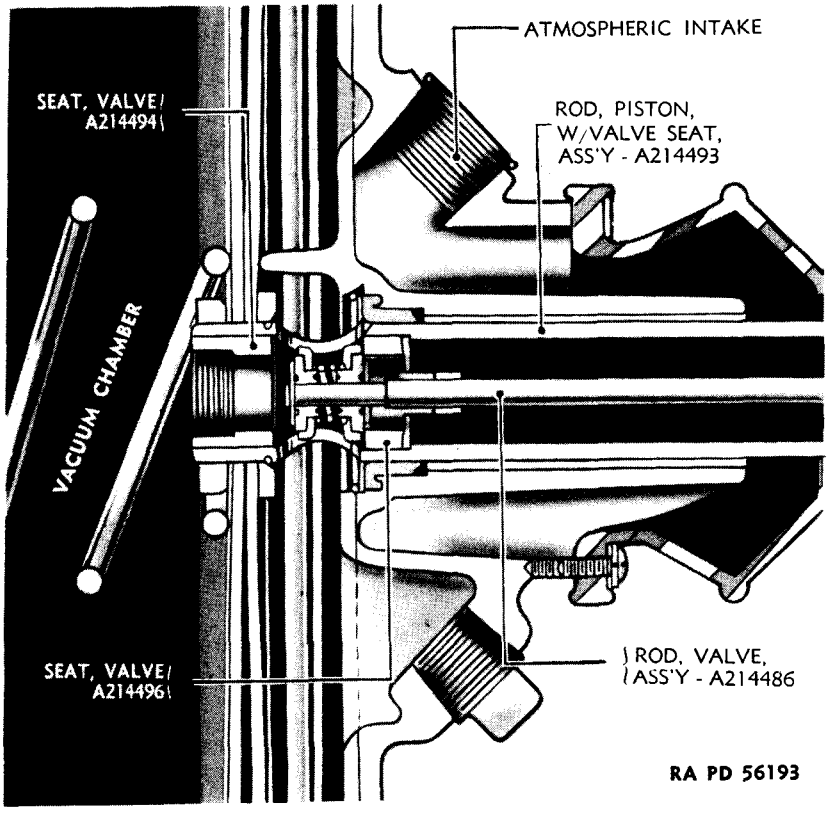


Figure 64—Vacuum Booster Valve Mechanism—Sectionalized

(c) The power cylinder atmospheric and vacuum valves are a sliding fit on the valve rod which is installed inside the tubular piston rod. The valves are held against their seats in the lap and applied positions by the valve spring between them. The valve assembly is held in the released position by the valve rod spring, on the front end of the rod, which has a greater spring tension than the valve spring.

(d) Surrounding the piston rod is a rubber boot which serves to receive the air from the air inlet nipple and direct it toward the intake ports on the front end of the piston rod.

(2) OPERATION.

(a) With the brake in the released position and the engine running, the vacuum in the engine manifold draws the air from the booster through the check valve and creates a vacuum in the booster shell. This vacuum is present on both sides of the pitson because, in theh releeased position, the vacuum valve seat in the center of the piston is uncovered and the air can be drawn from the front as well as the rear side of the piston.

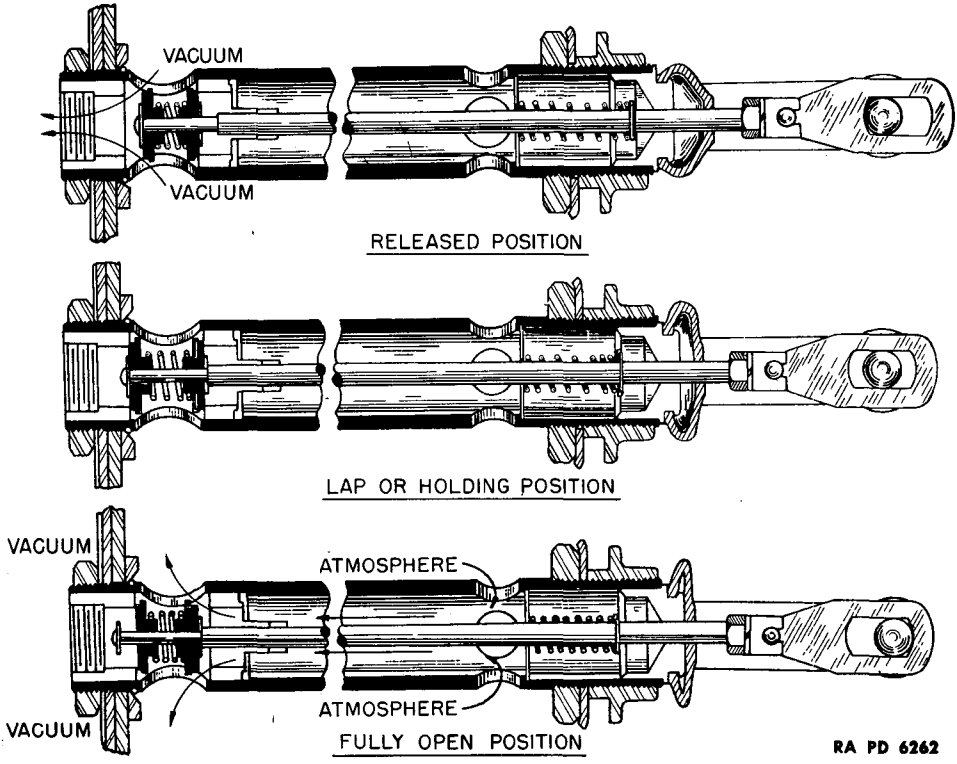


Figure 65—Vacuum Booster Valve Operation

(b) Air from the air cleaner at atmospheric pressure enters the boot through the fitting in the booster front end plate and enters the piston

rod through the portholes in the front end of the rod. With the brake pedal in the released position, the atmospheric valve is seated and seals the piston rod from the booster shell. This prevents the air at atmospheric pressure from entering the shell (fig. 64).

(c) (fig. 65A). Depressing the brake pedal approximately one inch will move the valve rod about $\frac{3}{16}$ inch toward the rear. The valve rod links will be centered around the clevis pin which connects the power levers to the booster yoke end, and the vacuum valve will be pushed toward the rear and seat against the piston front face, sealing the piston hole. The vacuum will thereby be cut off from the front side of the piston. This position, with the vacuum valve seated against the piston and cutting off the vacuum, and the atmospheric valve seated and sealing the front side of the piston from the air in the piston rod, is termed the lap position (fig. 65B). Any further depression of the brake pedal unseats the atmosphere valve by means of the shoulder on the valve rod, and allows the air at atmospheric pressure to enter against the front side of the piston (fig. 65C). This differential in pressure between the vacuum on the rear face and atmospheric pressure on the front face pushes the booster piston toward the rear, pulling the yoke end and power levers toward the rear, and thereby applying pressure to the master cylinder push rod and actuating the hydraulic brake system.

(d) The amount of brake application depends upon the position in which the operator stops the forward movement of the brake pedal. When the operator stops depressing the pedal, the valve rod remains in its assumed position and does not move further, since the valve rod and pedal are directly connected by the brake linkage and cannot move independently. The piston will continue to be pushed by the air being admitted until the piston rod has been moved toward the rear a sufficient amount to move the valve seat against the atmospheric valve and seal the air in the piston rod from the booster shell. The valve will then be in the lap position with both the atmosphere and vacuum portions seated. For any additional brake application, the brake pedal must be depressed further.

(e) When pressure is removed from the brake pedal the vacuum valve is unseated, admitting the vacuum to the front side of the piston, and the atmospheric valve is seated, cutting off the air from the piston rod. The vacuum balance on both sides of the piston is restored and the brakes are released.

(3) SPECIFICATIONS.

Make	Bendix	Ordnance No.	D48121
Model	R-76-6	White No.	376158
Manufacturer's No.	BX-371893	Autocar No.	24W510
		Diamond T No.	N4269

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) EXCESSIVE PEDAL PRESSURE.	
Leak in booster.	Replace end plates, cylinder packing ring, or piston felt and packing.
Improper valve action.	Adjust.
Leaky cylinder valve.	Replace valve rod assembly.
Leaky check valve.	Replace check valve stem or gasket.
Clogged air cleaner.	Clean.

c. Removal of Assembly.

Pliers
Screwdriver

(1) DISCONNECT VACUUM LINE.

Screwdriver

Loosen screw in clamp holding hose to booster and remove hose from fitting.

(2) DISCONNECT AIR CLEANER LINE.

Screwdriver

Loosen screw in clamp holding hose to booster and remove hose from fitting.

(3) DISCONNECT FRONT END OF BOOSTER.

Pliers

Remove cotter pin and rod end pin holding booster yoke to power levers and drop front end of booster.

(4) DISCONNECT REAR END OF BOOSTER.

Pliers

Remove cotter pin and rod end pin holding booster to yoke end rod on booster frame bracket. Remove booster assembly.

d. Disassembly (fig. 66).

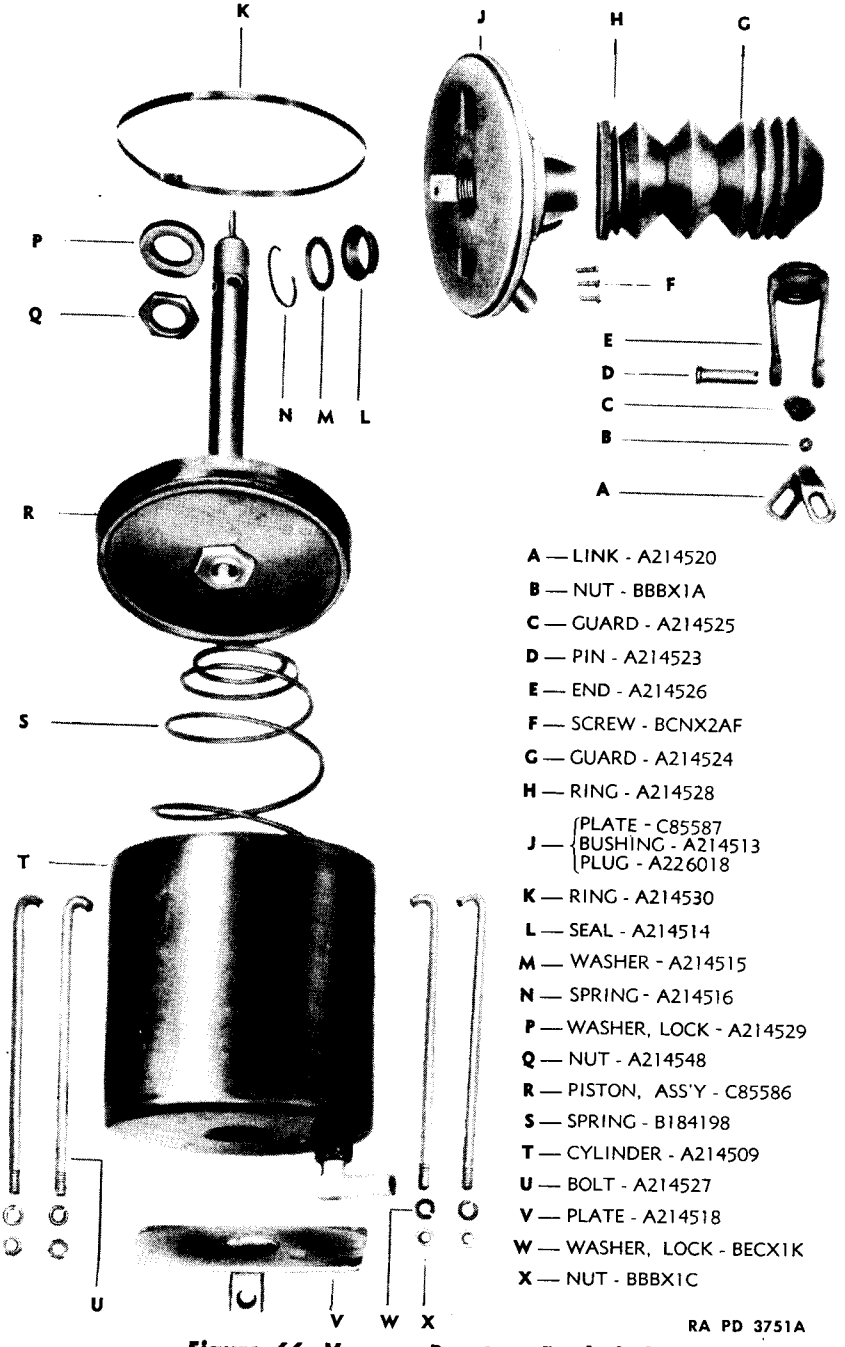
Drift, brass
Hammer
Press
Puller (BX-T-25105)
Puller (BX-T-25106)
Screwdriver
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, socket, $\frac{5}{8}$-in.
Wrench, socket, $1\frac{1}{4}$-in.

(1) REMOVE REAR END STUD PLATE.

Wrench, socket, $\frac{5}{8}$-in.

Remove four nuts and lock washers holding four hook bolts to stud plate assembly, and remove hook bolts and stud plate.

BRAKE SYSTEMS



A — LINK - A214520
B — NUT - BBBX1A
C — GUARD - A214525
D — PIN - A214523
E — END - A214526
F — SCREW - BCNX2AF
G — GUARD - A214524
H — RING - A214528
J — PLATE - C85587; BUSHING - A214513; PLUG - A226018
K — RING - A214530
L — SEAL - A214514
M — WASHER - A214515
N — SPRING - A214516
P — WASHER, LOCK - A214529
Q — NUT - A214548
R — PISTON, ASS'Y - C85586
S — SPRING - B184198
T — CYLINDER - A214509
U — BOLT - A214527
V — PLATE - A214518
W — WASHER, LOCK - BECX1K
X — NUT - BBBX1C

RA PD 3751A

Figure 66—Vacuum Booster—Exploded

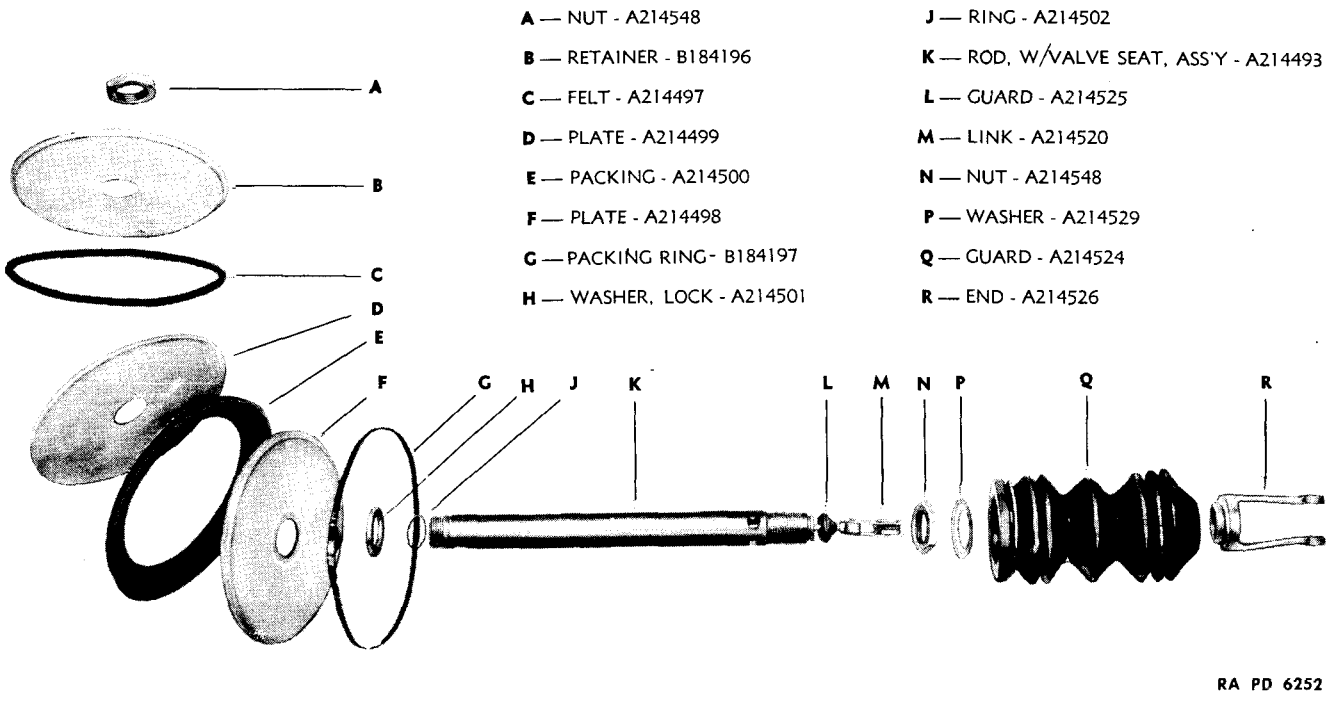


Figure 67—Vacuum Booster Piston and Rod Assembly—Exploded

(2) REMOVE PISTON AND ROD ASSEMBLY.

Slide piston and rod assembly and front end plate and guard out of booster cylinder. Remove piston return spring from cylinder.

(3) REMOVE PISTON FROM ROD.

Screwdriver — Wrench, socket, 1¼-in.

Remove piston rod nut that holds piston to rod (fig. 67). In order listed, remove following parts from rear end of piston rod: piston felt retainer, piston felt, rear piston plate, piston packing, front piston plate, piston packing ring, piston plate lock washer, and washer lock ring.

(4) REMOVE FRONT END PLATE ASSEMBLY.

Screwdriver

Remove three machine screws and lock washers holding piston rod guard retainer ring to front end plate. Remove front end plate and assembly by sliding off rear end of piston.

(5) DISASSEMBLE FRONT END PLATE AND SEAL ASSEMBLY.

Press — Screwdriver

Remove end plate spring from groove in bore of end plate. Remove end plate spring washer and piston rod seal. If necessary, the end plate bushing can be pressed or driven out of the end plate and bushing assembly. Remove cylinder packing ring from shoulder on the outer diameter of the end plate.

(6) REMOVE PISTON ROD GUARD.

Drift, brass — Hammer

Note number of threads on piston rod end extending through yoke end. The piston rod guard nut inside the guard is inaccessible to an ordinary wrench. Place yoke end in vise and loosen guard nut by means of the drift and hammer. Screw yoke end off the piston rod and slide rubber piston rod guard and washer off front end of rod. Remove the guard nut from rod.

(7) REMOVE VALVE ROD TRUNNION AND GUARD.

Wrench, open-end, $\frac{7}{16}$-in.

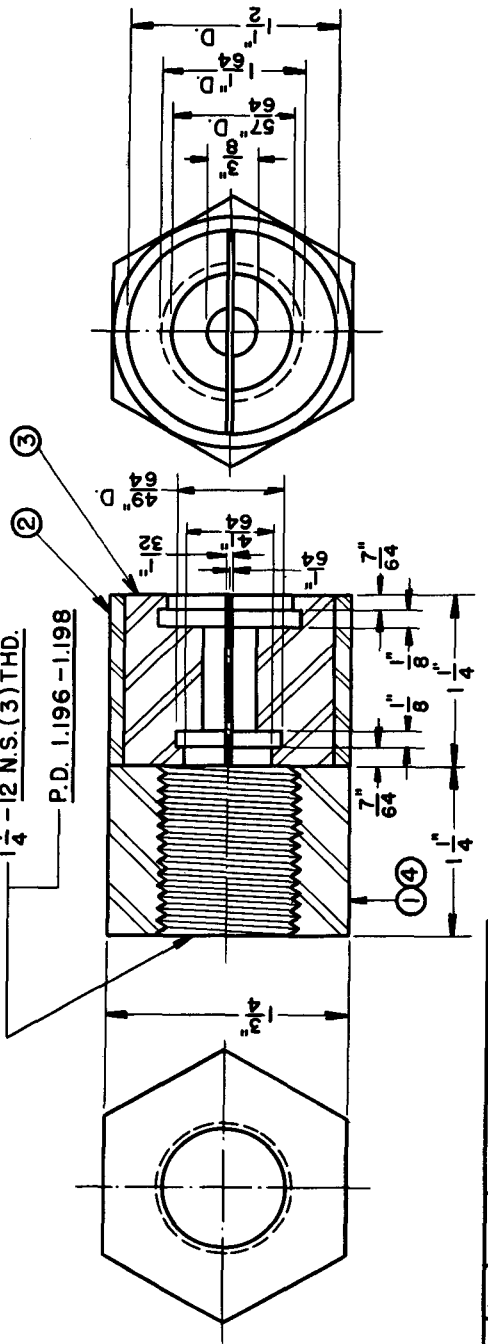
Note number of threads back of hexagon adjusting nut on valve rod. Back off hexagon nut far enough to allow the trunnion holding clip to be slipped back off the trunnion. After the clip is removed, the two valve links can be removed from the sides of the trunnion. Unscrew trunnion and remove clip and adjusting nut. Slip off valve rod guard.

(8) DISASSEMBLE YOKE END OF PISTON ROD.

Puller (BX-T-25106, fig. 68)

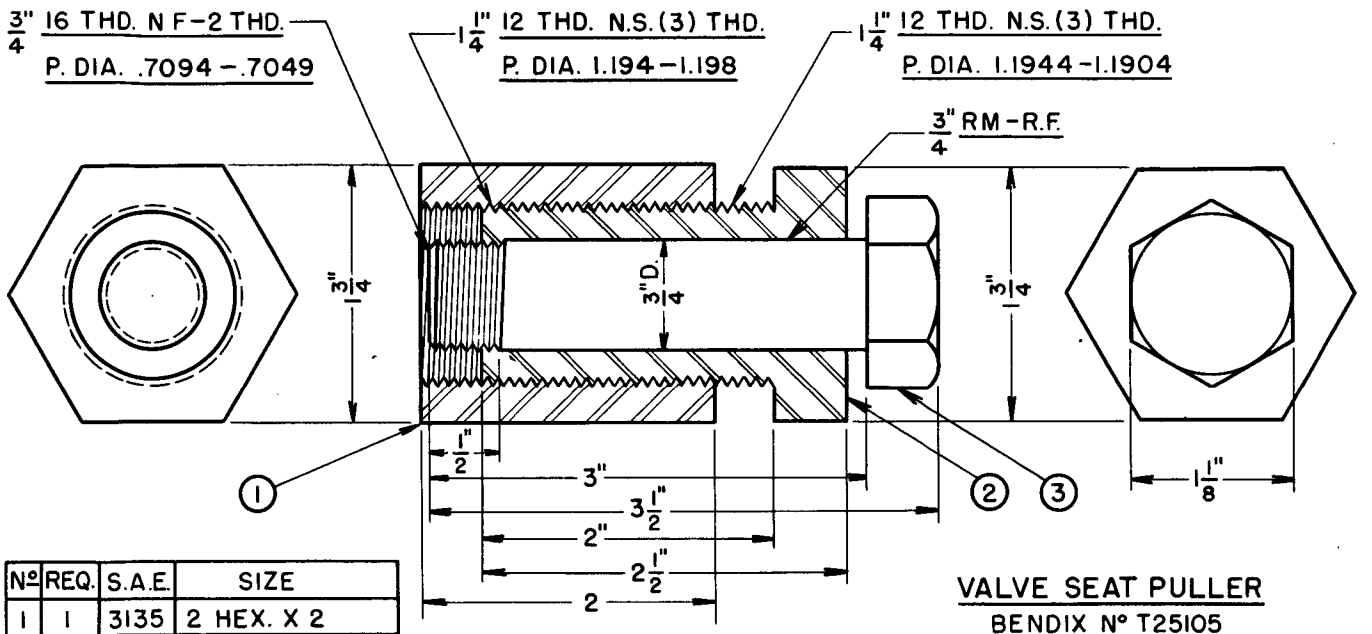
Remove valve rod guide from the front end of the piston rod using the special puller. Screw the puller nut on the end of the rod until it is

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES



NO.	REQ	MAT.	FINISHED SIZE
1	1	C.R.S.	1 3/4 HEX. X 1 1/4
2	1	STEEL TUBE	1 3/4 O.D. X 1 1/4 11 GA.
3	1	3138	1 1/2 DIA. X 1 1/4
4	1	C.R.S.	1 3/4 HEX. X 1 1/4

Figure 68—Vacuum Booster Valve Rod Guide Puller



Nº	REQ.	S.A.E.	SIZE
1	1	3135	2 HEX. X 2
2	1	3135	1 3/4 HEX. X 2 1/2
3	1	3135	1 1/8 HEX. X 3 1/2

Figure 69—Vacuum Booster Valve Seat Puller

below or flush with the end. Place the slots of the puller around the flange on the valve rod guide. Fit the puller sleeve around the two halves of the tool and back the large nut off the piston rod pulling the valve rod guide from the end of the piston rod. Hold the valve rod in what would be the released position, being careful not to damage the flexible valve disks. Push down on the vacuum valve and remove the horseshoe lock washer from the front end of the valve rod. Remove valve rod yoke and spring and washer.

(9) DISASSEMBLE PISTON END OF PISTON ROD.
Press Puller (BX-T-25105, fig. 69)

Screw the nut which is part of the puller assembly all the way down the threads on the piston end of the rod. Screw the large screw into the threads in the valve seat. Be certain that enough threads are engaged to securely hold the valve seat. Back out the puller sleeve inside the large hexagon nut and remove valve seat from piston rod. Remove the valve rod assembly from piston rod. The atmospheric valve seat can be pressed or driven out of piston rod. The valve rod assembly is not to be disassembled. Replace as a unit, if required. **NOTE:** For later model booster assemblies, the list of items that are removed from the yoke end of the piston rod is as follows: Sleeve, valve rod guide, washer, spring, and washer.

e. Maintenance and Adjustments.

(1) Inspect all rubber parts and replace if torn or swollen.

(2) Inspect piston felt and packing and replace if torn or shredded.

(3) Inspect front end plate. Rebush, or replace if sprung enough to cause leaks.

(4) Inspect piston plates and replace if bent.

(5) Inspect front end plate packing ring, and replace if torn.

(6) Inspect piston rod seal and replace if worn.

(7) Inspect valve rod and valves. If poppets are damaged or worn, replace entire valve rod assembly.

(8) Lubricate piston felt before assembly.

(9) Lubricate portions of valve rod which slip through valve rod guide and valve seat before assembly.

(10) Lubricate booster with two ounces of vacuum cylinder oil after assembly.

(11) Piston may stick from either corrosion or freezing. Lubricate to prevent corrosion, and add two ounces of ethylene glycol on each side of piston to prevent freezing when operating in low temperatures.

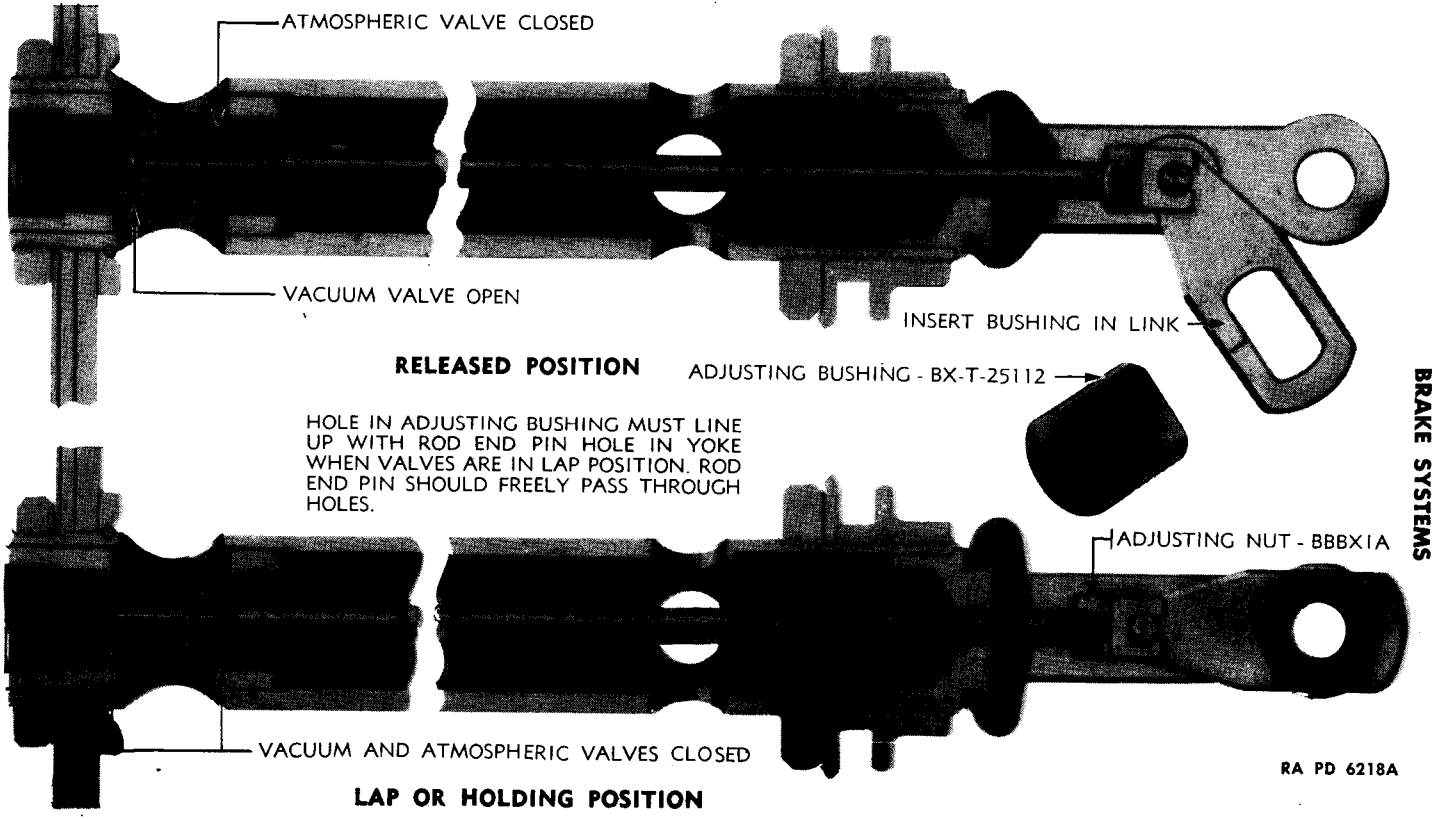


Figure 70—Vacuum Booster Valve Adjustment.

(12) ADJUSTMENT OF VALVES (fig. 70).

(a) This adjustment should be performed after assembly of valve rod into piston rod and also after assembly of the entire vacuum booster unit. Before the piston assembly is installed in the cylinder, and while the movement of the valves may be watched, swing the valve rod links down, and insert adjusting bushing (fig. 71). Push the links back into alinement with the piston rod yoke and push in on the valve until the vacuum valve just seats. With the vacuum valve just seated, adjust the yoke until a new clevis pin will fit freely through the adjusting bushing and the piston rod yoke.

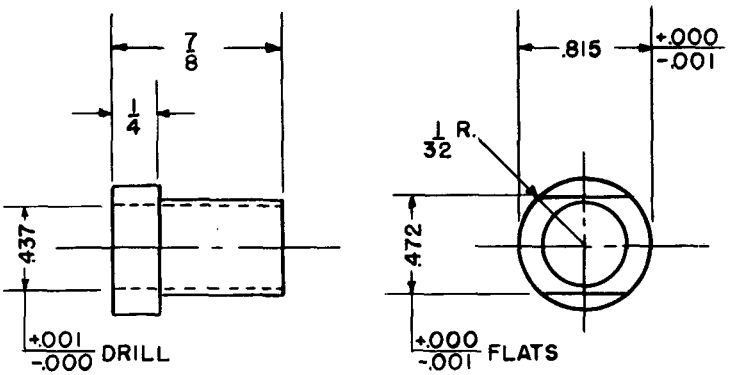


Figure 71—Vacuum Booster Valve Adjusting Bushing

(b) Valve overlap should now be checked. Valve overlap is the distance the valve rod travels inward between the time the vacuum valve seats and the atmospheric valve is unseated by the shoulder on the valve rod. This distance or overlap should not be less than 0.005 inch or more than 0.020 inch. If overlap is too little, push vacuum valve seat in further; if it is too great, pull valve seat out slightly.

(c) To test valve adjustment after complete reassembly or while the unit is installed in the vehicle, remove piston rod yoke end cotter pin and rod end pin. Drop valve rod links and insert adjusting bushing in links. Hold the valve rod links horizontal and push toward the rear. The valve rod will move easily until the lap position of the valve is reached. Greater effort is required to move the valve rod beyond lap position in order to open the atmospheric valve, because the valve spring aids in closing the vacuum valve, but both the valve spring and the front valve rod spring resist moving the valve beyond the lap position. With the valve in the lap position, the hole in the adjusting bushing must line up with the rod end pin hole in the piston rod yoke end so that the rod end pin can be inserted freely. If the holes do not line up, loosen valve rod link lock nut and adjust links to line up the holes. After completing adjustment, tighten lock nut.

(13) SERVICE DATA.

Piston return spring

Free length	13 3/8 in.
Pressure at 6 1/16 in.	23 lb

(6 1/16 in. corresponds to inserted height at fullest extended position of cylinder.)

f. Reassembly (figs. 66 and 67).

Drift, brass	Screwdriver
Hammer	Vise
Press	Wrench, open-end, 7/16-in.
Puller (BX-T-25105)	Wrench, socket, 5/8-in.
Puller (BX-T-25016)	Wrench, socket, 1 1/4-in.

(1) ASSEMBLE PISTON ROD.

Puller (BX-T-25105)	Puller (BX-T-25106)

Replace atmospheric valve seat and install valve rod assembly. Replace vacuum valve seat using the special puller. Replace washer and spring and install valve rod guide in the yoke end of piston rod using special puller. Check adjustment of valves.

(2) REPLACE VALVE ROD TRUNNION AND GUARD.

Wrench, open-end, 7/16-in.

Replace small guard on flange on valve rod guide. Install adjusting nut and holding clip on valve rod. Screw on trunnion and set valve links on trunnion ends. Push holding clip over ends of trunnion, and tighten adjusting nut. Check to see that the same number of threads can be counted as before disassembly.

(3) REPLACE PISTON ROD GUARD.

Drift, brass	Vise
Hammer	

Screw guard nut on piston rod and slip washer on. Set guard on end of rod and replace yoke end. Adjust number of threads extending through yoke end as before disassembly. Set yoke into vise and tighten guard nut by striking with drift and hammer.

(4) REASSEMBLE FRONT END PLATE.
Press

Replace bushing in end plate. Set piston rod seal in place in end plate. Replace washer and spring in groove. Replace packing ring on outer diameter of plate.

(5) REPLACE FRONT END PLATE.
Screwdriver

Slide front end plate on valve end of piston rod, and replace three screws that hold the piston rod guard retainer ring to front end plate.

(6) REPLACE PISTON ON ROD.
Screwdriver
Wrench, socket, 1¼-in.

Replace piston plate lock ring, lock washer, front piston plate, packing spring, packing, rear piston plate, piston felt, and felt retainer in the order named. Replace piston rod nut on end of rod.

(7) REPLACE PISTON AND ROD ASSEMBLY. Set piston return spring in place in shell with the larger end toward the rear. Slide the piston and rod assembly into shell.

(8) REPLACE REAR END STUD PLATE.
Wrench, socket, ⅝-in.

Set plate on back end, and replace four hook bolts and nuts and lock washers.

g. Installation of Assembly.
Pliers
Screwdriver

(1) CONNECT REAR END OF BOOSTER.
Pliers

Set the booster into position, and replace rod end pin and cotter pin that connects booster to frame bracket.

(2) CONNECT FRONT END.
Pliers

Replace rod end pin and cotter pin holding booster yoke end to power levers.

(3) CONNECT VACUUM AND AIR LINES.
Screwdriver

Replace hoses on fittings on booster, and tighten hose clamps.

(4) ADJUST LINKAGE. See maintenance.

h. Test.

(1) Remove filler pipe plug in booster front end plate and connect to a vacuum gage.

(2) Start the engine and note the reading on the gage. It should show a vacuum of 17 to 20 inches. Stop the engine and note whether vacuum is retained for a reasonable length of time. If the gage shows a rapid falling off (more than 10 inches in 10 seconds) it indicates a leak in the cylinder, vacuum line, check valve or inlet manifold connector. Leakage in the vacuum booster may often be corrected by a thorough lubrication of the unit.

25. BOOSTER AIR CLEANER AND CHECK VALVE.

a. Air Cleaner.

(1) DESCRIPTION (fig. 72). The remote air cleaner is provided to filter the air entering the vacuum booster through the cleaner hair. It is mounted on the engine side of the dash underneath the generator regulator bracket and is connected to booster air intake by a tube.

Make Bendix	White No. 376419
Manufacturer's No. BK22506	Autocar No. 24W386
Ordnance No. B184194	Diamond T No. N6344

(2) REMOVAL OF ASSEMBLY.

Screwdriver
Wrench, open-end, $2\frac{7}{16}$-in.

(a) Air Cleaner Removal.

Screwdriver
Wrench, open-end, $2\frac{7}{16}$-in.

Remove two bolts, nuts and lock washer holding air cleaner to dash. Loosen hose clamp and remove air cleaner assembly.

(3) DISASSEMBLY.

Screwdriver
Wrench, open-end, $1\frac{1}{2}$-in.
Wrench, open-end, $1\frac{3}{8}$-in.

(a) Disassemble Air Cleaner.

Screwdriver
Wrench, open-end, $1\frac{1}{2}$-in.
Wrench, open-end, $1\frac{3}{8}$-in.

Remove machine screw from top of cover and remove washer, cover, upper screen, hair, lower screen and shell from tube. Remove nut holding bracket to air cleaner and remove bracket.

(4) MAINTENANCE. Wash hair thoroughly in SOLVENT, dry-cleaning; dry, and then saturate with OIL, engine, SAE 10.

(5) REASSEMBLY.

Screwdriver
Wrench, open-end, $1\frac{1}{2}$-in.
Wrench, open-end, $1\frac{3}{8}$-in.

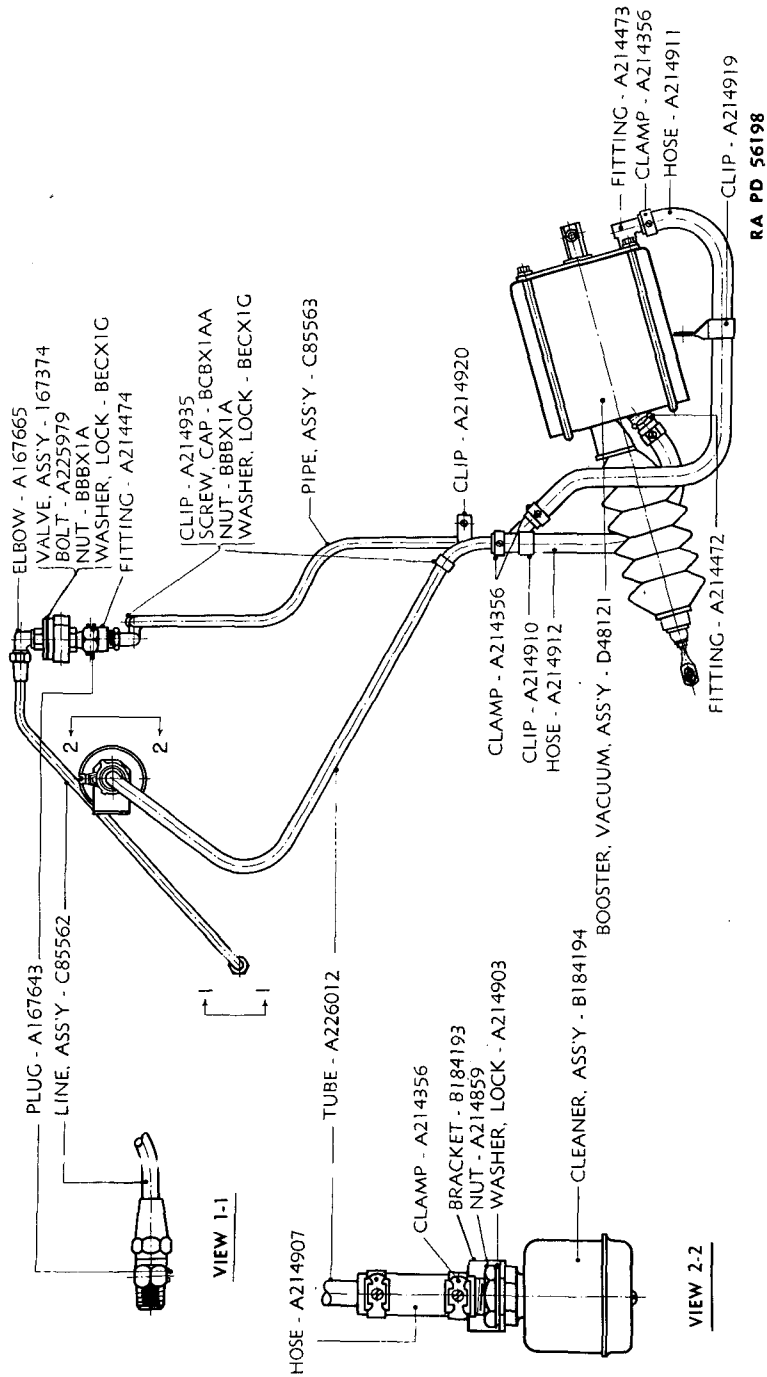


Figure 72—Vacuum System—Schematic

(a) Reassemble Air Cleaner.

Screwdriver
Wrench, open-end, 1 1/2-in.
Wrench, open-end, 1 3/8-in.

Replace bracket and nut on tube, and replace shell, lower screen, hair, upper screen, cover, and cover screw.

(6) INSTALLATION OF ASSEMBLY.

Wrench, open-end, 2 7/16-in.

(a) Replace Air Cleaner.

Wrench, open-end, 2 7/16-in.

Set in position, and replace two bolts, nuts, and lock washers. Connect hose to air cleaner tube.

b. Check Valve.

(1) DESCRIPTION (fig. 72). A check valve, mounted on the front right side of dash, is provided in the vacuum system of the brake booster between the engine intake manifold and the booster vacuum inlet. With the engine running, and air being drawn out of the booster to the intake manifold in order to create the vacuum required in the booster, the check valve remains open and the air passes through. As soon as the engine stops and the intake manifold vacuum is broken, the check valve closes and prevents air from going from the manifold to the booster, thereby, keeping whatever vacuum exists in the booster from being broken. This feature is particularly useful in case of engine stall during vehicle operation. If the vacuum in the booster were broken, it might be difficult to stop the vehicle as quickly as desired.

Make Bendix	Ordnance No. A167374
Manufacturer's No.	White No. A33439
BX-BK-16864	Autocar No. 24W240
	Diamond T No. N3525

(2) REMOVAL OF ASSEMBLY.

Wrench, open end, 5/8-in.
Wrench, open-end, 2 7/16-in.
Wrench, open-end, 1-in.

(a) Remove Check Valve.

Wrench, open-end, 5/8-in.
Wrench, open-end, 2 7/16-in.
Wrench, open-end, 1-in.

Remove coupling nut on line assembly from elbow on top of the check valve. Remove coupling on line assembly from nipple fitting on bottom of check valve. Remove two bolts, nuts, and lock washers holding check valve to dash and remove valve.

(3) DISASSEMBLY.

Pliers
Screwdriver

(a) Disassemble Check Valve.

Pliers
Screwdriver

Remove nipple and elbow from check valve and slide rubber bracket off valve. Remove four machine screws and lock washers and remove valve cap and gasket. Lift valve stem out of valve body.

(4) MAINTENANCE.

(a) Inspect valve stem and replace if bent or worn.

(b) Replace check valve cap gasket.

(5) REASSEMBLY.

Pliers — Screwdriver

(a) Reassemble Check Valve.

Pliers — Screwdriver

Replace valve stem in body and replace gasket, cap and four screws and lock washers. Slip rubber bracket over body, and replace elbow and nipple.

(6) INSTALLATION OF ASSEMBLY.

Wrench, open-end, 7/8-in. — Wrench, open-end, $2\frac{7}{16}$-in.
Wrench, open-end, 1-in.

(a) REPLACE CHECK VALVE.

Wrench, open-end, 7/8-in. — Wrench, open-end, $2\frac{7}{16}$-in.
Wrench, open-end, 1-in.

Set valve in place and replace two bolts, nuts, and lock washers. Connect pipes to elbow and nipple.

26. SERVICE BRAKE LINES.

a. Description (fig. 53).

(1) Two main fluid lines for the hydraulic service brake system start respectively from the left and right outlet fittings of the master cylinder, which is attached to the rear of the clutch and brake pedal bracket. The 1/4-inch pipe which feeds the front wheel brake lines starts from the left-hand outlet fitting of the master cylinder and runs along the inside of the frame to the tee. The line is held by three clips which are attached to the frame, as is also the tee. The tee has two openings, one facing forward and the other toward the rear. The flared tube nut at the end of the left wheel cylinder pipe screws into the rear opening and connects the pipe to the tee. The pipe then runs backward along the inside of the frame rail until it is approximately opposite the wheel cylinder, at which point it is connected to the wheel cylinder flexible hose fitting by means of another flared tube nut. The flexible hose fitting is a special type (fig. 73) which passes through the frame from the wheel side and is attached to the frame. The flexible hose completes the line from the tee to the left wheel cylinder where it is attached to the cylinder inlet fitting. The hose is held by two clips which are attached to the steering knuckle upper bearing plate studs.

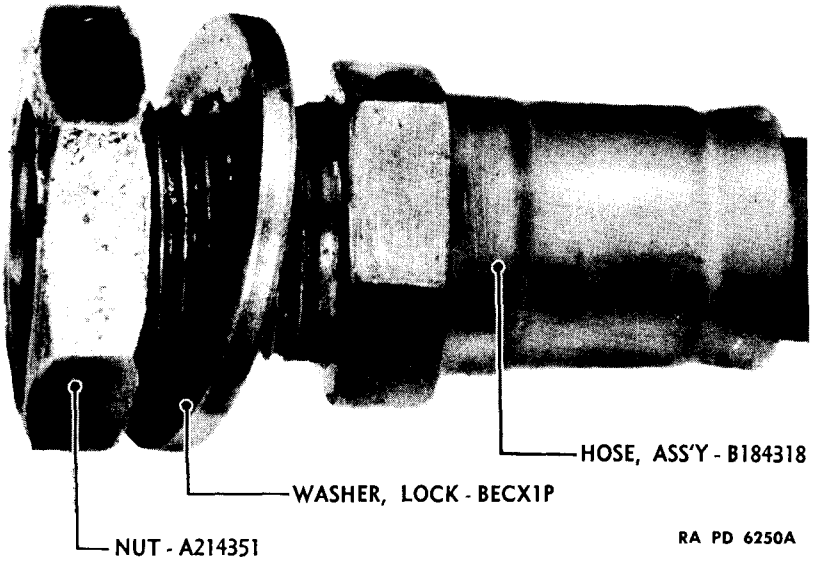


Figure 73—Front Wheel Brake Line Connection at Frame

(2) The flared tube nut at the end of the pipe leading to the right-hand wheel cylinder, screws into the front end of the tee and connects the pipe to the tee. After leaving the tee, the pipe crosses to the right-hand frame rail along the front cross member of the frame and then runs backward along the inside of the frame rail to a point opposite the wheel cylinder. There its flared tube end fitting screws into the wheel cylinder flexible hose fitting in the same manner as the left-hand pipe. The pipe is held by three clips bolted to the front cross member and one clip which is bolted to the right-hand frame rail. It is connected to the right-hand wheel cylinder by a flexible hose similar to the one used on the left side.

(3) The $\frac{5}{16}$-inch feed pipe for the rear brakes is attached to the outlet fitting on the right side of the master cylinder and runs back along the inside of the frame to the rear hose bracket. The pipe is held by one clip which is bolted to the frame rail. The flared tube nut fitting at the bracket end of the pipe screws into the flexible hose fitting which is attached to the bracket in the same manner as the front hose fittings

are attached to the frame. The flexible hose connects the pipe to the tee which is bolted to the back of the rear differential housing by means of a lock washer and cap screw. Two ¼-inch pipes screw into the left and right side of the tee and connect the tee to the rear left and right wheel cylinder fittings. Flared tube nut fittings are used at the wheel cylinder end of the pipes.

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) Loss of Fluid in System.	
Loosen connection.	Retighten.
Damaged flared tube end.	Straighten with flaring tool or Replace.
Ruptured tube or hose.	Replace.
(2) Failure of One or More Wheel Brakes to Operate.	
Plugged flexible hose.	Clear hose if possible, or replace.
Plugged tube.	Replace.

c. Removal of Assemblies.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, ⅝-in.
Wrench, open-end, ¾-in.
Wrench, open-end, $\frac{15}{16}$-in.
Wrench, socket, $\frac{15}{16}$-in.

(1) Remove Front Wheel Cylinder Hose Assemblies.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ¾-in.
Wrench, socket, $\frac{15}{16}$-in.

Remove protecting armor side plates attached to inner side of frame at each side of engine. Disconnect flared tube nuts at frame end of hoses. Disconnect each hose fitting from frame by removing holding nut and lock washer. Free hose clips at steering knuckle and remove hose assemblies from wheel cylinder inlet fittings.

(2) Remove Line Assembly (Front Tee to Left-hand Wheel).

Wrench, open-end, $\frac{7}{16}$-in.

Disconnect inverted flared tube nut at tee and drop line assembly.

(3) Remove Line Assembly (Front Tee to Right-hand Wheel).

Wrench, open-end, $\frac{7}{16}$-in.

Disconnect inverted flared tube nut at tee. Detach clips holding line assembly to frame, and drop assembly.

(4) REMOVE LINE ASSEMBLY (MASTER CYLINDER TO FRONT TEE).
Wrench, open-end, $\frac{7}{16}$-in.

Disconnect inverted flared tube nuts from tee and master cylinder outlet fitting. Detach clips from frame and drop line assembly.

(5) REMOVE FRONT TEE.

Take out bolt, nut, and lock washer holding tee to frame.

(6) REMOVE LINE ASSEMBLY (MASTER CYLINDER TO REAR HOSE CONNECTION).

Wrench, open-end, ½-in.

Disconnect flared tube nuts at master cylinder rear outlet fitting and at rear hose fitting. Detach clip holding line assembly to frame and lower assembly.

(7) REMOVE HOSE ASSEMBLY (REAR CONNECTION TO AXLE TEE).
Wrench, open-end, $\frac{5}{8}$-in. Wrench, open-end, $\frac{15}{16}$-in.
Wrench, open-end, ¾-in.

Remove nut and lock washer holding hose fitting to bracket. Disconnect hose assembly at tee and lower assembly.

(8) REMOVE LINE ASSEMBLY (REAR AXLE TEE TO LEFT-HAND WHEEL).
Wrench, open-end, $\frac{7}{16}$-in. Wrench, open-end, $\frac{9}{16}$-in.

Disconnect inverted flared tube nut at tee and flared tube nut at wheel cylinder, and remove line assembly.

(9) REMOVE LINE ASSEMBLY (REAR AXLE TEE TO RIGHT-HAND WHEEL).
Wrench, open-end, $\frac{7}{16}$-in. Wrench, open-end, $\frac{9}{16}$-in.

After removing cap screw and lock washer holding line clip to axle housing, proceed as in step (8), above.

(10) REMOVE REAR TEE.
Wrench, open-end, $\frac{5}{8}$-in.

After removing line connections at tee, take out cap screw and lock washer holding tee to housing.

d. Maintenance.

(1) Very little maintenance is required on the hydraulic lines, since damaged parts can usually be replaced as assemblies. However, if no pipe assemblies are available, they can be made in the following manner:

(a) Cut a straight piece of steel tubing to the required length, using cutter shown in figure 74. It is very important that the tubing be cut at right angles to its length, since it is to be flared.

(b) Remove the bur left inside the tubing. Use the reamer attached to the cutting tool or the reamer furnished with the flaring tool.

(c) Cut the pipe assembly which is to be placed, and remove the end fittings.

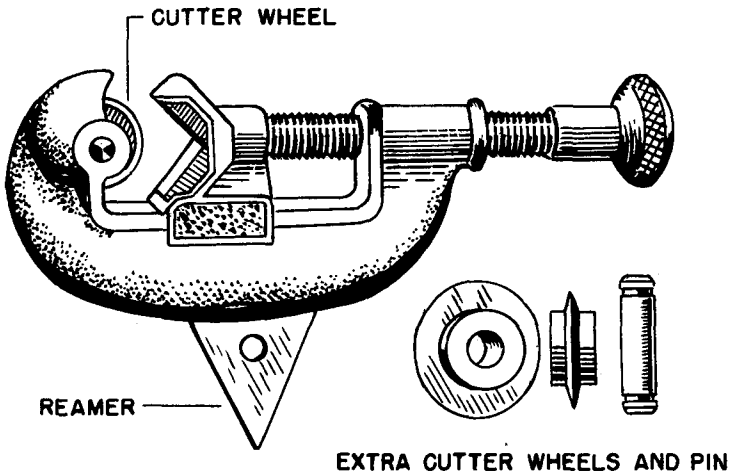


Figure 74—Hydraulic Tubing Cutter

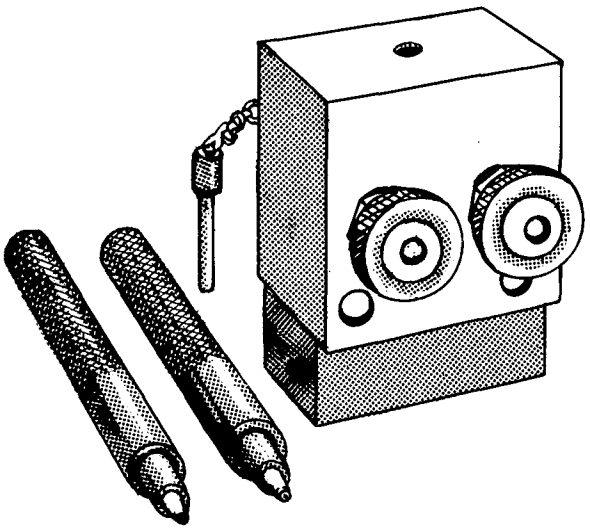


Figure 75—Hydraulic Tubing Flaring Tool

(d) Place each fitting on the end of the new tube which is to be flared, and place the end of the tube in the flaring tool (fig. 75).

(e) Form the flare by means of mandrel.

(2) *Bleeding the Line.* Bleeding the line consists of displacing all the air which may have accumulated in the system with the fluid. This is done by forcing the fluid through the lines until it flows in a solid stream from the bleeder valve on each of the four wheel cylinders. This is necessary only when some part of the hydraulic mechanism has been disconnected or the fluid in the supply tank has been allowed to become too low. Only genuine Lockheed Brake Fluid No. 21 should be used for refilling. Proceed in the following manner:

(a) Remove the two screws holding the floor plate over the master cylinder filler plug, and remove plate.

(b) Unscrew the filler plug on top of the tank.

(c) Using a Wagner Lockheed Fluid Filler, insert nozzle into filler hole as shown in figure 76.

(d) Starting with the wheel cylinder farthest from the master cylinder, remove the bleeder valve cap screw, after which the nipple at the end of the rubber drain tube may be screwed in place (fig. 77).

(e) Slide the bleeder valve wrench over the rubber tube, and place the free end of the tube below the level of the brake fluid in a clean pint-size glass container.

(f) Open the valve three-quarters of a turn.

(g) Depress the foot pedal slowly by hand, allowing the return spring to return the pedal to its release position. Approximately ten strokes of the pedal will be required to bleed each wheel cylinder, until fluid issues from the end of the tube in a solid stream without air bubbles.

(h) As each wheel cylinder is bled, the bleeder valve is shut off tightly with the wrench, the bleeder tube is removed, and the cap screw with lock washer is replaced.

(i) After a cylinder has been bled, do not again depress the brake pedal until the valve of the next cylinder is opened, because air may be forced over from a line yet to be bled to a line on which this operation has been completed.

(j) Do this for all four brake cylinders. When this has been completed, remove the fluid refiller from the supply tank, and replace the filler plug and floor plate.

e. Installation of Assemblies.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{1}{2}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{5}{8}$-in.
Wrench, open-end, $\frac{3}{4}$-in.
Wrench, open-end, $1\frac{5}{16}$-in.
Wrench, socket, $1\frac{5}{16}$-in.

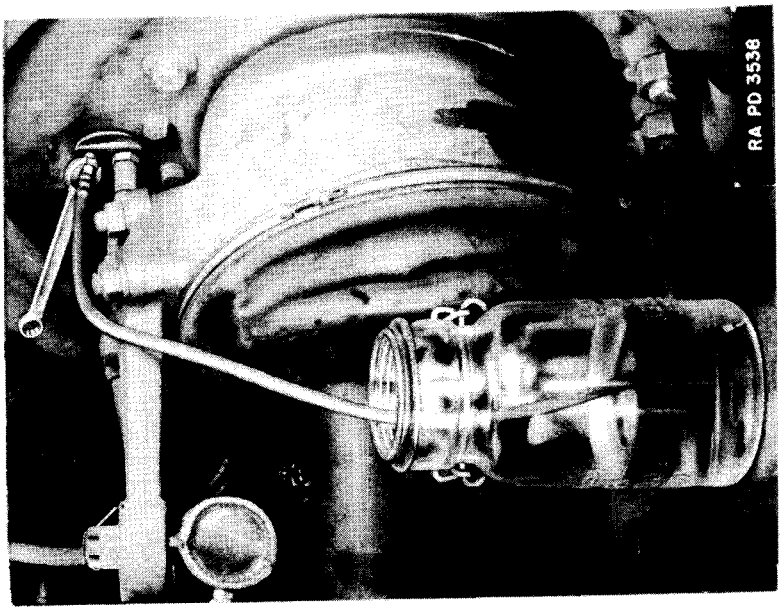


Figure 77—Hydraulic Brake System Bleeding Operation

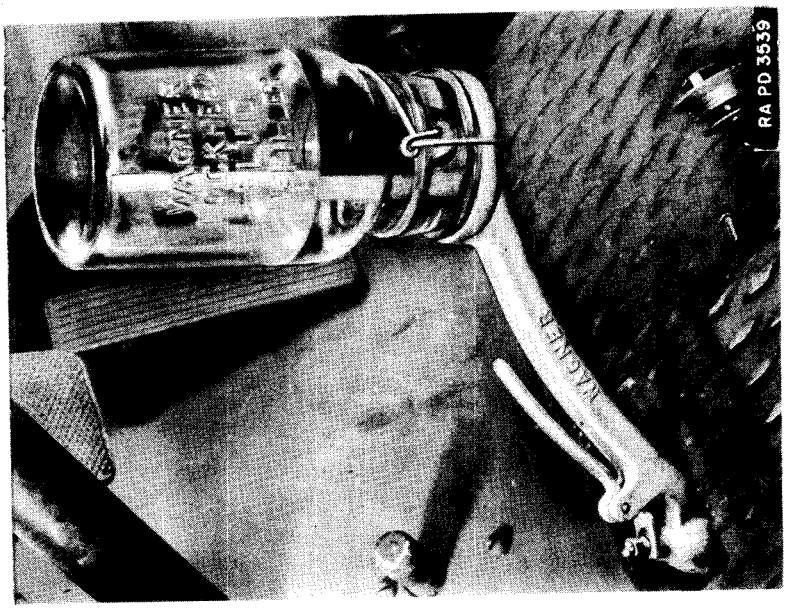


Figure 76—Hydraulic Brake Fluid Replacement in Master Cylinder

BRAKE SYSTEMS

(1) REPLACE REAR AXLE TEE.
Wrench, open-end, 5/8-in.
Secure tee to axle housing with lock washer and cap screw.

(2) REPLACE LINE ASSEMBLIES TO REAR WHEEL BRAKE CYLINDERS.
Wrench, open-end, 7/16-in. Wrench, open-end, 9/16-in.
Connect proper end of each assembly to the tee by means of its inverted flared tube nut. Then connect opposite ends to wheel cylinder fittings with the flared tube nuts. Fasten right-hand line clip to frame.

(3) REPLACE REAR FLEXIBLE HOSE.
Wrench, open-end, 5/8-in. Wrench, open-end, 15/16-in.
Wrench, open-end, 3/4-in.
Connect one end of hose to tee by means of its inverted flared tube nut, and fasten fitting at opposite end to bracket with lock washer and nut.

(4) REPLACE LINE ASSEMBLY (master cylinder to rear hose connection).
Wrench, open-end, 1/2-in.
Connect one end of pipe to rear hose fitting and the opposite end to master cylinder fitting by means of its inverted flared tube nuts. Fasten line clip to frame.

(5) REPLACE FRONT TEE. Secure tee to frame with bolt and lock washer.

(6) REPLACE LINE ASSEMBLY (master cylinder to front tee).
Wrench, open-end, 7/16-in.
Connect one end of assembly to master cylinder outlet fitting and opposite end to tee. Fasten three line clips to frame.

(7) REPLACE FRONT WHEEL BRAKE FLEXIBLE HOSE ASSEMBLIES.
Wrench, open-end, 7/16-in. Wrench, socket, 15/16-in.
Wrench, open-end, 3/4-in.
Connect assemblies to each front wheel cylinder inlet fitting. Secure hose clips to steering knuckle bearing plate studs, and replace stud nuts. Insert special fitting, at opposite end of each hose, through frame, and secure it with lock washer and nut. Attach engine protecting side plates to frame.

(8) REPLACE PIPE ASSEMBLIES (tee to left- and right-hand wheel).
Wrench, open-end, 7/16-in.
Connect one end of each assembly to tee by means of its inverted flared tube nut. Then connect opposite end of each assembly to right- and left-hand wheel hose fitting in the same manner. Fasten the four right-hand line clips to frame.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

27. WHEEL BRAKES.

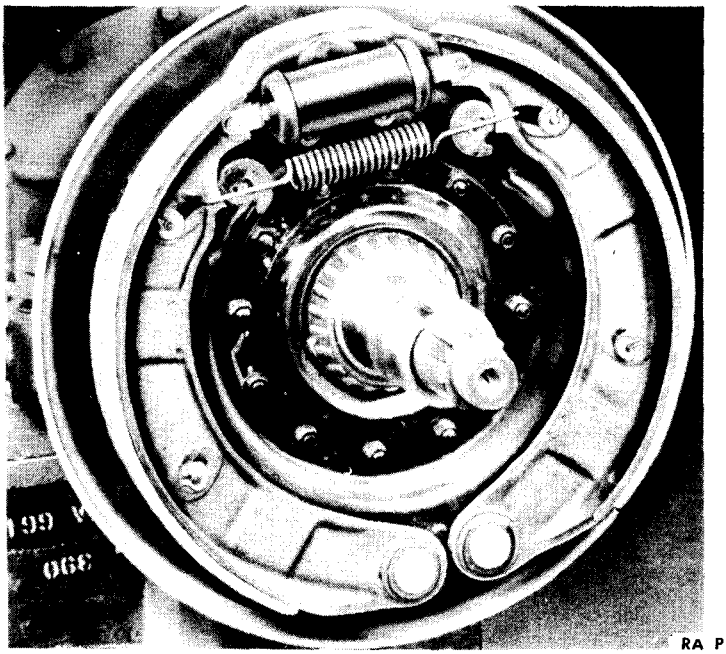
a. Description. The wheel brakes, front and rear, are of the conventional, hydraulic, two-shoe, internal expanding type. They are enclosed in brake drums of special gun iron material with high wear resisting qualities.

(1) CONSTRUCTION (figs. 78 and 79).

(a) The brake shoes are T-shaped steel castings, and the linings are riveted to them on the outside periphery. The shoes are anchored to the brake backing plate at the heel (lower end) by eccentric anchor pins, plain washers and C-shaped washers which fit into a groove in the pins. The eccentric pins carry felt washers in retainers back of the shoes and are attached to the brake backing plate by nuts and lock washers. Each shoe has two guide slots which fit over guide pins riveted to the backing plate. The shoes are held onto these pins by means of plain washers and C washers, the C washers fitting into grooves cut in the pins. The toes (upper end) of the shoes are recessed to accommodate the clevis pins of the wheel cylinder connecting link assemblies. The shoes are held against adjusting cams by means of a return spring, the ends of which are hooked onto the upper guide slots. The cams are fixed to adjusting pins and are held in position by means of coiled friction springs. The adjusting pins are installed from the rear of the brake locking plate and have hexagon heads to facilitate rotation.

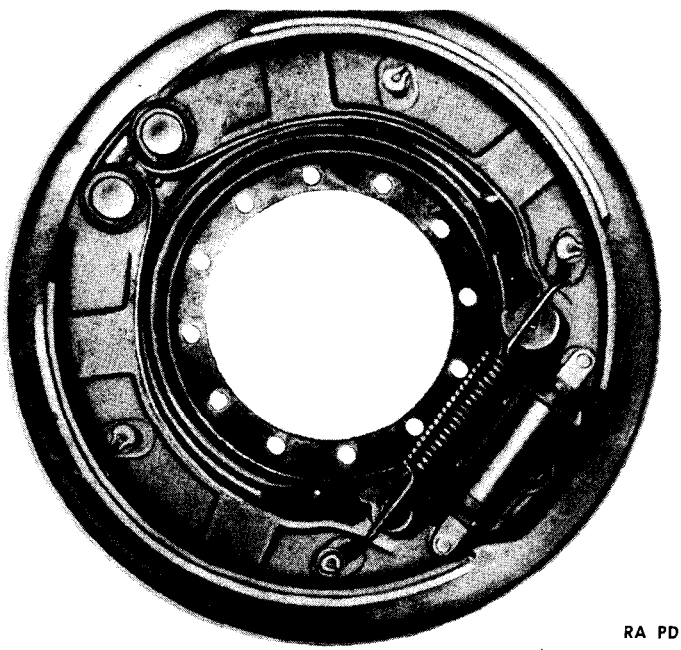
(b) The wheel brake cylinder housings are cast iron, and each is bolted to its respective brake backing plate at the top by two cap screws and lock washers (fig. 80). Two holes are drilled and tapped through the boss at the rear of the cylinder, and into these are threaded the brake hose and bleeder valve fittings. Each cylinder contains a piston spring, two rubber cups, two pistons, two rubber boots, and two connecting links with riveted yoke end pins. The spring is located in the center of the cylinder, and the cups fit onto each end of the spring. The pistons are a close fit and are installed with their flat end against the cups. The rubber boots fit over the ends of the cylinder housing and snap into grooves cut around the outside of the housing. The connecting links pass through holes in the center of the boots and seat in spherical cups in each piston. They are held in place by the brake shoes.

(2) OPERATION. Fluid forced out of the master cylinder passes through the lines into the brake cylinders and exerts its energy against the pistons. This causes the pistons and connecting links to move outward, and the rods pushing against the upper ends of the shoes makes them pivot on their anchor pins and contact the brake drums. When the pressure is released at the brake pedal, the brake shoe retracting spring



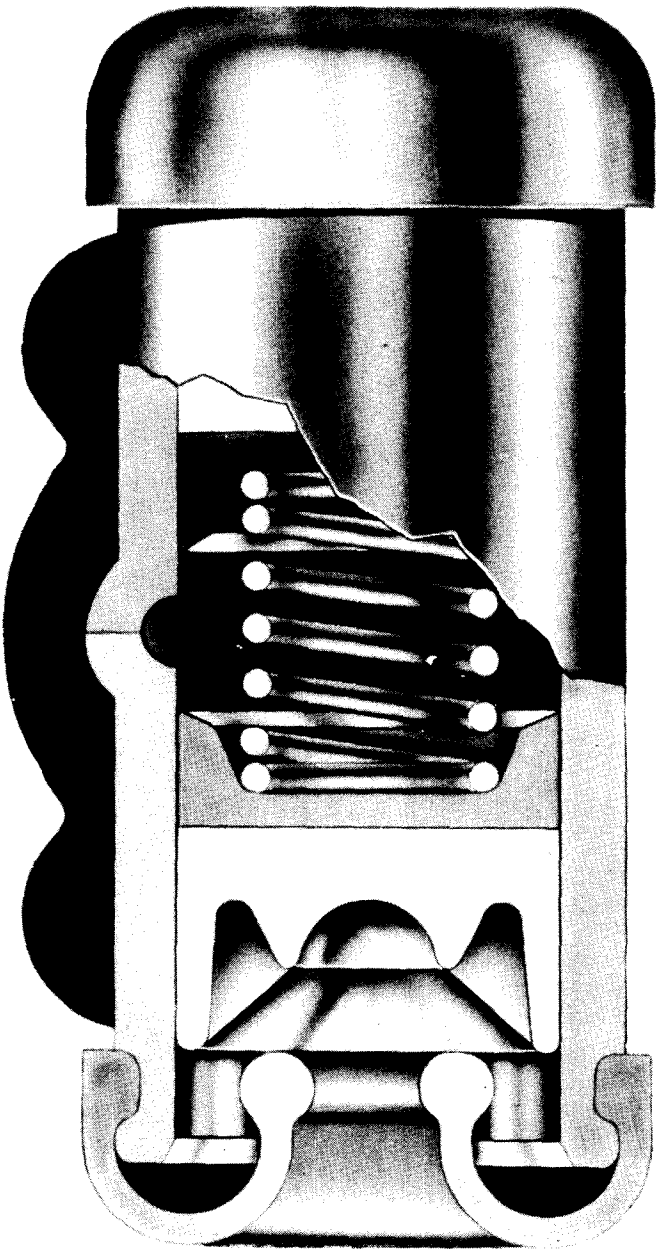
RA PD 3571A

Figure 78—Front Wheel Brake Assembly—Installed



RA PD 3688

Figure 79—Front Wheel Brake Assembly—Rear View



RA PD 6249

Figure 80—Front Wheel Brake Cylinder—Sectionalized

brings the shoes back to their original position, forcing the cylinder pistons back into the cylinder, and this in turn forces the fluid out of the cylinder and back through the lines to the master cylinder. By turning the adjusting cam bolts, the shoes can be set closer to the drums or moved away from them. The guide pins tend to prevent too much side movement of the shoes.

(3) SPECIFICATIONS.

Make	Wagner Electric
Type	Internal Expanding
Model	Hydraulic two-shoe
Manufacturer's No.	LO-FC-7762
Ordnance No.	
Front, L. H.	D48211
Front, R. H.	D48212
Rear, L. H.	D48174
Rear, R. H.	D48175
White No.	
Front, L. H.	382222
Front, R. H.	382223
Rear, L. H.	382225
Rear, R. H.	382226

Service brake type	Four-drum hydraulic
Wheel cylinder	**Sprocket cylinder**
Size	1 3/8 in.
Wheel brake shoes	**Sprocket brake shoes**
Size	15 x 2 1/4 in.
Lining area (sq in. per axle)	128 1/2 in.
Length (forward)	16 3/4 in.
Length (reverse)	12 3/16 in.
Width	2 1/4 in.
Thickness	1/4 in.

Sprocket cylinder	
Size	1 3/4 in.
Sprocket brake shoes	
Size	15 x 3 1/2 in.
Lining area (sq in. per axle)	205 2/3 in.
Length (forward)	16 3/8 in.
Length (reverse)	16 3/16 in.
Width	3 1/2 in.
Thickness	1/4 in.

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) PEDAL GOES TO FLOOR BOARD.	
Normal wear of linings.	Adjust brake shoes.
Brake not properly adjusted.	Adjust shoes.
(2) ALL BRAKES DRAG.	
Mineral oil in system.	Flush system, and replace wheel cylinder cups.

Symptom and probable cause	Probable remedy
(3) ONE WHEEL DRAGS.	
Weak brake shoe return spring.	Replace spring.
Brake shoe bearing seized to anchor pin.	Lubricate bearing at anchor pins.
Brake shoe set too close to drum.	Readjust shoes to proper clearance.
Wheel cylinder cups distorted.	Replace cups.
(4) CAR PULLS TO ONE SIDE.	
Grease-soaked lining.	Replace with new lining of same make.
Shoes improperly set.	Readjust shoes to proper clearance.
Different makes of linings.	Replace with lining of same make.
(5) SPRINGY, SPONGY PEDAL.	
Brake shoes not properly adjusted.	Readjust shoes.
Air in system.	Bleed system at wheel cylinders.
(6) EXCESSIVE PRESSURE ON PEDAL, POOR STOP.	
Brake shoes not properly adjusted.	Readjust shoes.
Improper lining.	Replace with a proper lining.
Oil in linings.	Clean or replace lining.
(7) LIGHT PRESSURE ON PEDAL, SEVERE BRAKES.	
Brake shoes not properly adjusted.	Readjust shoes to proper clearance.
Grease-soaked lining.	Replace with new lining of same make.

c. Removal of Assembly.

(1) BRAKE SHOES.

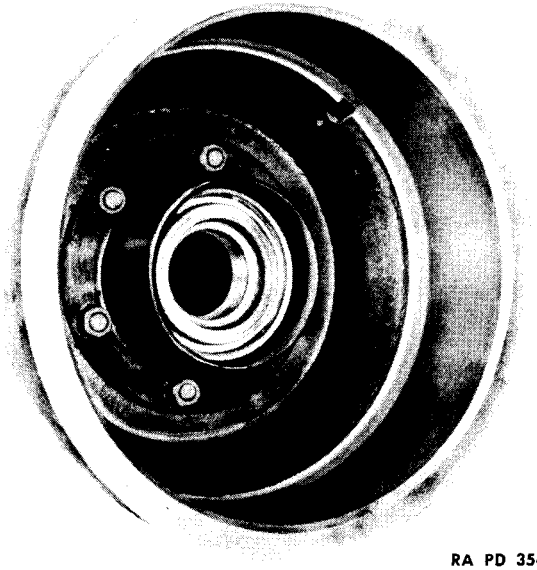
Clamp, wheel cylinder	Pliers, spring, special
Hammer	Screwdriver

(a) Remove front wheel and brake drum or rear sprocket and brake drum (fig. 81).

To remove front wheel and drum, follow steps as explained under Front Axle, Section V, TM 9-1710. To remove rear sprocket and drum, follow steps as explained under Rear Axle, Section VI, TM 9-1710.

(b) Remove Shoe Retracting Spring.

Clamp, wheel cylinder	Pliers, spring, special



RA PD 3542A

Figure 81—Brake Drum

Clamp ends of wheel cylinder to keep pistons in place (fig. 82), and remove spring as shown in figure 83.

(c) Remove Guide Pin Washers.

Hammer
Screwdriver

Place screwdriver against tang ends of C washers, and drive them from pins by hitting screwdriver. Then take off plain washers.

(d) Remove Brake Shoe Assemblies.

Screwdriver

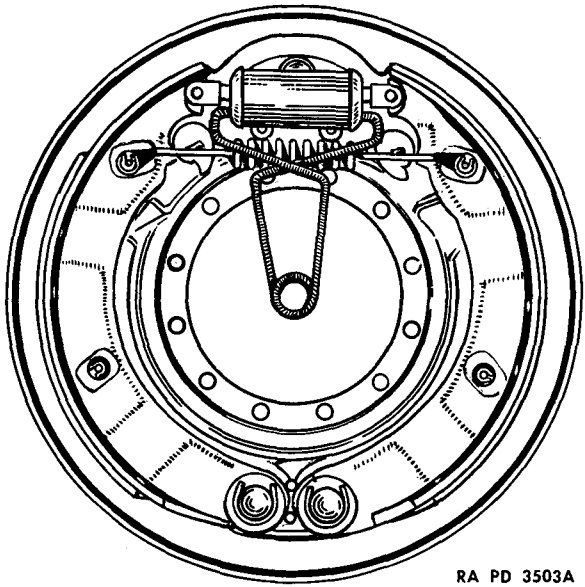
Remove anchor pin C washers by forcing screwdriver under end of washer and twisting. Then remove spacer washers, and slip off shoe assemblies (fig. 84).

(2) WHEEL CYLINDER.

Clamp, cylinder
Pliers, spring, special
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{3}{4}$-in.
Wrench, socket, $\frac{3}{4}$-in.
Wrench, socket, $\frac{15}{16}$-in.

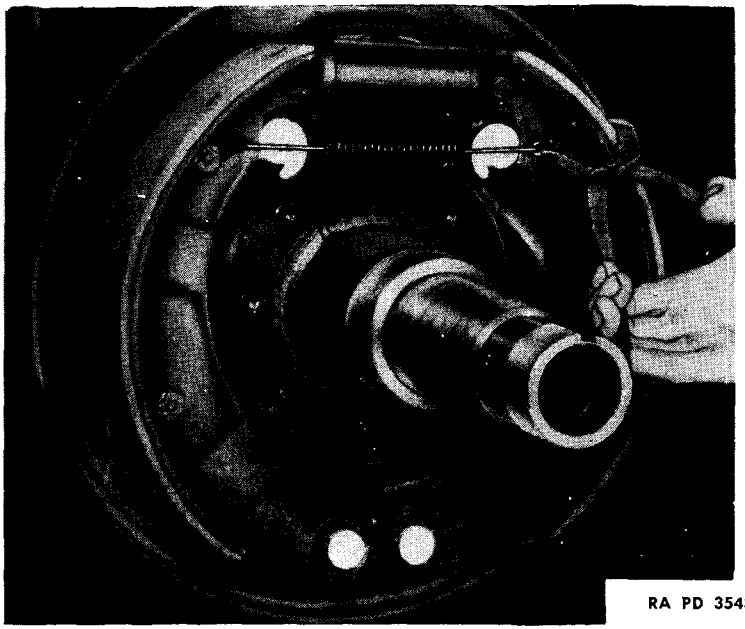
(a) Remove Front Wheel and Brake Drum or Rear Sprocket and Drum.

See operation c *(a)*, above.



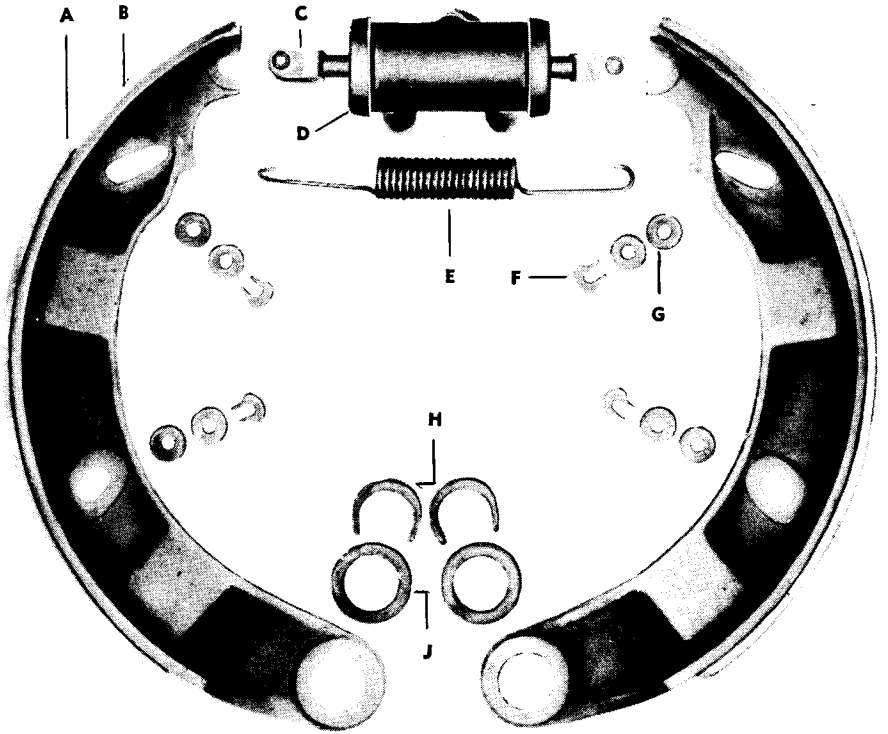
RA PD 3503A

Figure 82—Clamping Wheel Brake Cylinder



RA PD 3543A

Figure 83—Removing Brake Shoe Return Spring



A — LINING - {FORWARD - B184344 / REVERSE - B184345

B — SHOE, ASS'Y - {FORWARD - B184342 / REVERSE - B184343

C — LINK, ASS'Y - A214973

D — CYLINDER, ASS'Y - A214970

E — SPRING - A214972

F — WASHER - A160353

G — WASHER - A186743

H — WASHER - A160337

J — WASHER - A186635

RA PD 6248

Figure 84— Rear Wheel Brake—Exploded

(b) Disconnect Brake Hose.

Wrench, open-end, $\frac{7}{16}$-in. Wrench, socket, $\frac{5}{16}$-in.
Wrench, open-end, $\frac{3}{4}$-in.

Each front brake hose must first be disconnected at frame. To do this remove engine protecting armor plate by removing holding bolts. This facilitates access to hose connection. Break connection, and then loosen steering knuckle bearing plate nuts holding hose clips so that hose can turn in its clips. The hose can now be disconnected at cylinder inlet fitting. Each rear brake tube can be disconnected at the cylinder without any preliminary steps.

(c) Remove Shoe Retracting Spring.

Clamp, cylinder Pliers, spring, special

Place clamp over ends of wheel cylinder (fig. 82), and remove spring as shown in figure 83.

(d) Remove Cylinder.

Wrench, socket, $\frac{3}{4}$-in.

Remove cap screws and lock washers holding cylinder to backing plate, and take out cylinder assembly.

d. Disassembly of Components.

(1) BRAKE SHOES.

Hammer Punch

(a) Remove Linings.

Hammer Punch

Drive out rivets holding linings to shoes, and remove linings.

(2) WHEEL CYLINDER (fig. 85).

Wrench, open-end, $\frac{7}{16}$-in. Wrench, open-end, $\frac{7}{8}$-in.
Wrench, open-end, $\frac{3}{4}$-in. Wrench, pipe, small

(a) Remove Working Parts.

Pull out yoke end connecting links, rubber boots, pistons, cups, and piston return spring.

(b) Remove Fittings.

Wrench, open-end, $\frac{7}{16}$-in. Wrench, open-end, $\frac{7}{8}$-in.
Wrench, open-end, $\frac{3}{4}$-in. Wrench, pipe, small

Remove inlet fitting bolt, bolt gasket, inlet fitting, and fitting gasket. Then take out bleeder screw cap screw, lock washer, and bleeder screw.

e. Maintenance and Adjustments.

(1) Inspect brake shoes for cracks and wearing of the anchor pin holes. If apparent, replace with new shoes.

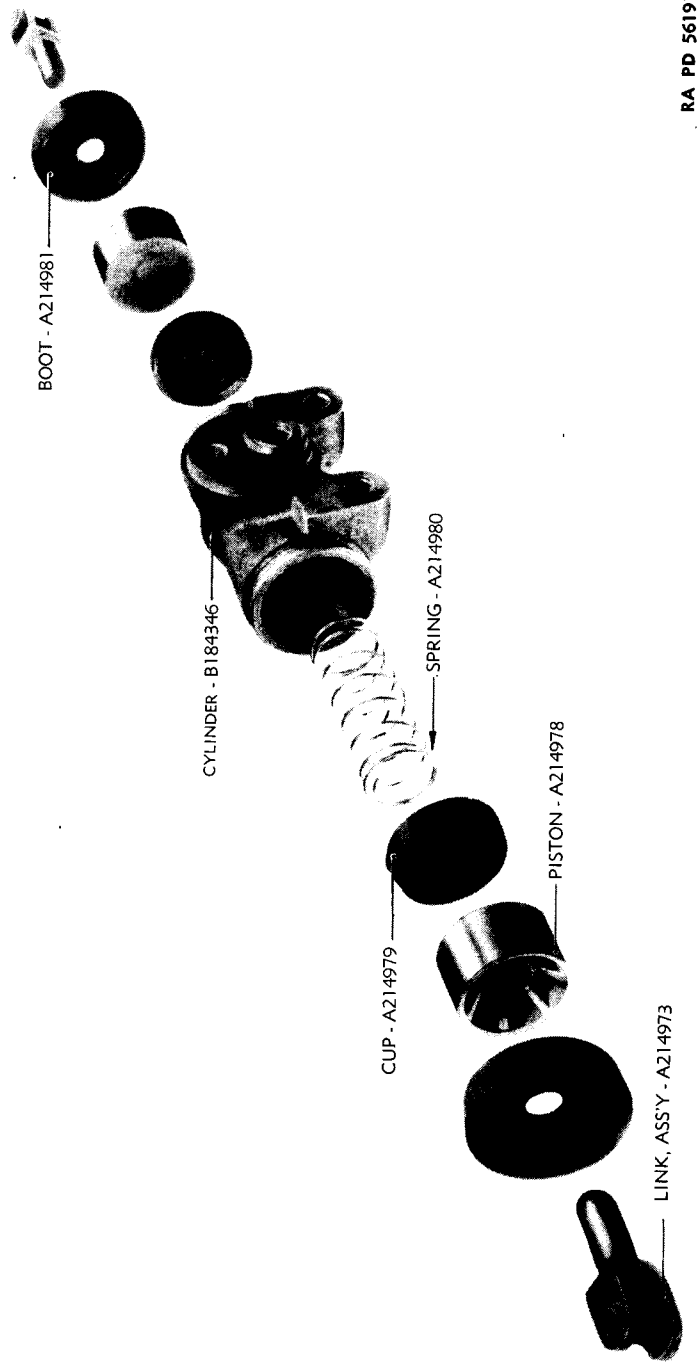


Figure 85— Rear Wheel Brake Cylinder—Exploded

(2) Inspect adjusting cam friction springs and shoe retracting springs for breaks or evidence of permanent set, and replace with new ones if required.

(3) Inspect anchor pins and their felt washers, and replace any that shows signs of wear.

(4) If a minor adjustment of the breaks is required for any of the reasons listed under Trouble shooting, paragraph **b**, above, it may be done in the following manner:

(a) Without removing the wheels or sprockets, raise the vehicle until the wheels are free of the ground.

NOTE: When adjusting the rear brakes, it is necessary to remove the track as explained under Section V, paragraph 15.

(b) Rotate the cam at the top of the front shoe until the lining is pressed firmly against the drum and the wheel is locked.

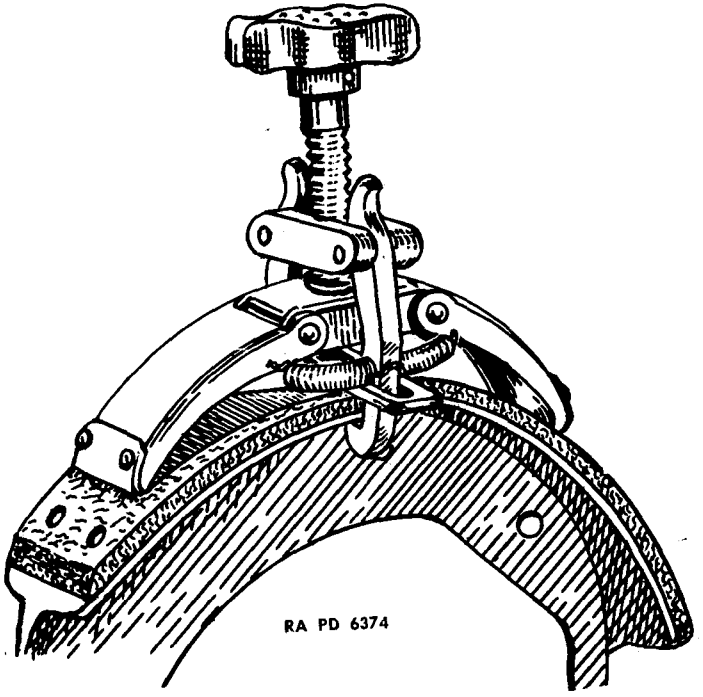


Figure 86—Holding Brake Lining While Riveting to Shoe

(c) Then back off the adjustment slightly until the wheel rotates freely without drag.

(d) Adjust all eight brake shoes in this manner. These cams are automatically locked in position by their friction springs.

(5) If, upon inspection, the brakes require relining for any of the reasons listed under Trouble shooting, paragraph **b**, above, proceed in the following manner:

(a) Remove the old linings by following paragraph **c** (1), and step (*a*), paragraph **d** (1), above.

(b) Set the new linings on the brake shoes, and hold them in place with a suitable clamp (fig. 86).

(c) Rivet the linings to the shoes with the correct type of rivets (fig. 87). Never use aluminum rivets.



RA PD 6374A

Figure 87—Riveting Brake Lining

(d) Countersink the rivet heads in the linings approximately two-thirds the thickness of the linings.

(e) Chamfer the ends of the linings back about ¾ inch from the top and bottom, and remove high spots and burs around the rivet holes with a grinding tool or a fine file (fig. 88). Do not use emery paper.

(f) Reinstall the brake shoe assemblies as explained under Installation of assembly, paragraph **g**, below.

(6) After the brakes have been relined or the brake drums resurfaced,

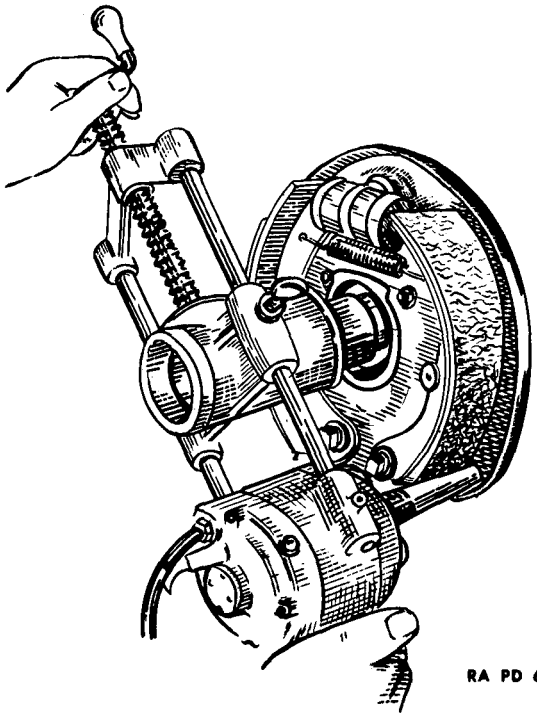


Figure 88—Beveling Edges of Brake Lining

a major adjustment of the shoes is necessary and should be done in the following manner:

(a) With the wheels and drums in place and the vehicle raised, remove the inspection hole covers in the wheel brake drums. If the rear sprocket drums are not accessible, the sprockets should be dismounted to expose the brake drums. The sprockets are removed by following steps as explained under Rear Axle, Section VI, TM 9-1710.

(b) Insert a thickness gage through the inspection hole, between the lining and drum (fig. 90).

(c) Loosen the holding bolt at the rear of the backing plate, and turn the eccentric anchor pins at the "heel" or lower end of the brake shoe. At a distance of one inch from the end of the lining near this pin, the clearance between lining and drum should be 0.005 inch.

(d) Tighten the holding nut and recheck clearance.

(e) Turn the wheel and drum assembly until the inspection hole in the drum is at the "toe" or upper end of the shoe.

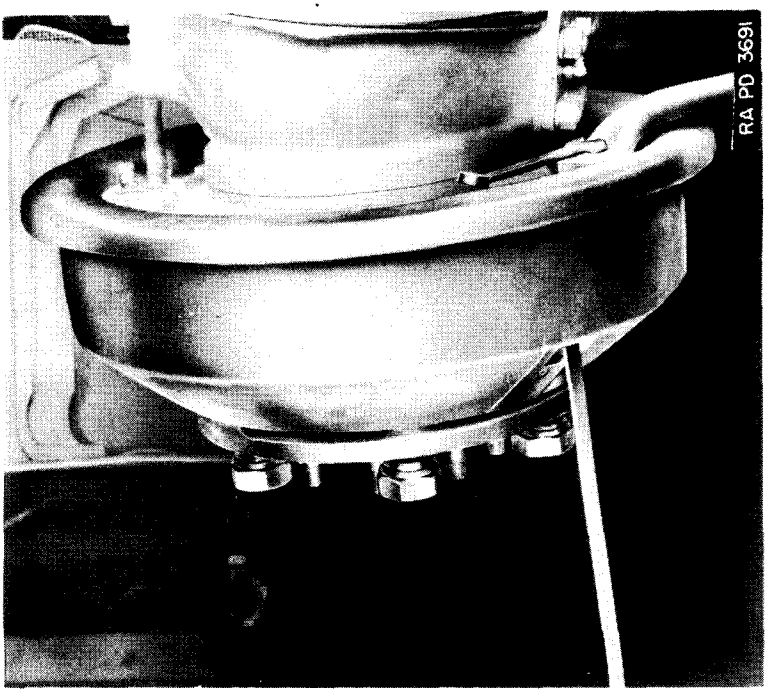


Figure 90—Wheel Brake Shoe Heel Adjustment

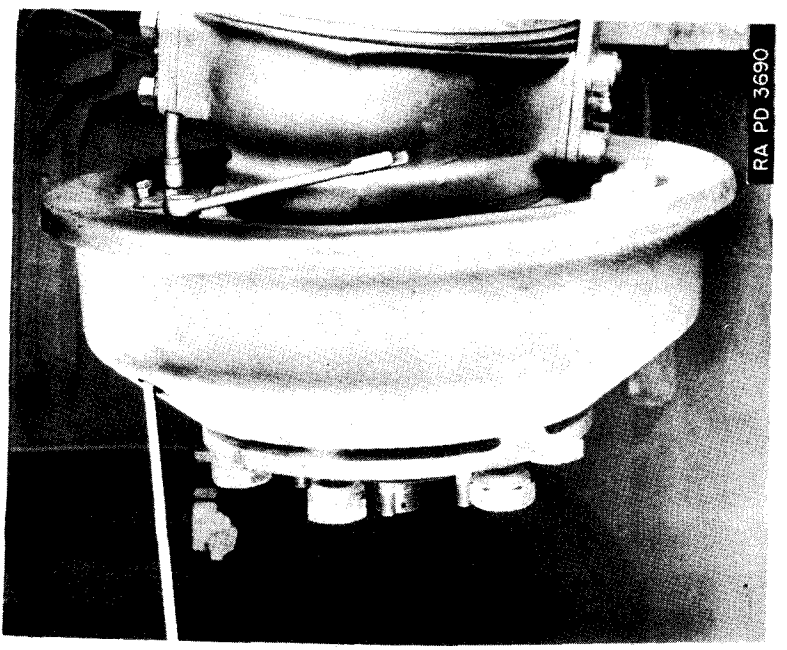


Figure 89—Wheel Brake Shoe Toe Adjustment

(f) Insert a gage between the lining and drum one inch from the end of the lining, and turn the adjusting cam nut until the lining has a clearance of 0.010 inch (fig. 89).

(g) Remove the gage and replace the inspection hole cover.

(h) Check the pedal travel before and after these adjustments, and tighten holding bolts. Repeat these operations on each shoe in each drum.

(7) Inspect brake drums for scoring. Resurface if necessary, by turning on drum lathe.

(8) After a wheel cylinder has been disassembled, the working parts should be washed in alcohol and inspected for the following:

(a) If any mineral oil has found its way into the system, the rubber cups will be enlarged and very soft. If this condition is apparent, the cups should be replaced.

(b) Cylinder walls must be smooth (not pitted or scratched). The walls may be renewed by honing. If this is done, a no-go gage should be used to determine whether the diameter has been enlarged to a point where the casting cannot be used.

(c) Pistons must be free from burs; if any are apparent, they should be removed with a fine file.

(d) Occasionally, wheel bearing grease seals become worn and allow grease to leak through into the brake drum and come in contact with the cylinder rubber boots. When this occurs, the boots become soft and enlarged, preventing them from protecting the cylinder from foreign matter. If this occurs, replace boots and grease retainer.

(e) Check the return spring for permanent set; if apparent, replace with a new spring.

NOTE: Never wash cylinder or parts in gasoline, kerosene, or oil.

(9) SERVICE DATA.

Wheel cylinders	
Piston clearance, front brake	0.001 in.-0.005 in.
Piston clearance, rear brake	0.001 in.-0.005 in.
Front and rear shoe adjustment	
Top of shoe	by cam
Bottom of shoe	by eccentric
Brake return springs	
Front cylinder piston	
Free length	2 5/8 in.
Pounds pressure at 1 3/4 in.	1 to 1 1/4 lb
Rear cylinder piston:	
Free length	3 1/8 in.
Pounds pressure at 2 in.	1 1/2 to 2 lb

Shoe return springs:
Free length $7\frac{3}{16}$ in.
Pounds pull at $8\frac{1}{4}$ in. 75 to 85 lb
Brake drum
Regrinding limits 0.030 in.

f. Reassembly of Components.

(1) BRAKE SHOES.

Clamp — Punch, rivet
Grinder or file

Replace or renew linings. Follow steps *(b)* through *(e)* as explained under paragraph e (5), above.

(2) WHEEL CYLINDER (fig. 85).

Clamp — Wrench, open-end, $\frac{7}{8}$-in.
Wrench, open-end, $\frac{7}{16}$-in. — Wrench, pipe, small
Wrench, open-end, $\frac{3}{4}$-in.

(a) Replace working parts.

Clamp

Dip parts in brake fluid and then place piston spring in center of cylinder and install rubber cups onto each end of spring with their flat faces out. Insert pistons into each end of cylinder, flat face first, so that they butt against flat face of cups. Slip rubber boots over each end of cylinder, and insert connecting links through holes in boots until they seat into pistons. Hold parts in place by clamping ends of cylinder.

(b) INSTALL FITTINGS.

Wrench, open-end, $\frac{7}{16}$-in. — Wrench, open-end, $\frac{7}{8}$-in.
Wrench, open-end, $\frac{3}{4}$-in. — Wrench, pipe, small

Turn bleeder screw and inlet fitting and gasket into cylinder housing. Then turn cap screw and lock washer into bleeder screw and bolt and gasket into inlet fitting.

g. Installation of Assembly.

(1) BRAKE SHOES.

Hammer, light — Pliers, spring, special

(a) Replace shoes.

Hammer, light

Set felt seals and retainers on anchor pins and plain washers on guide pins. Then place shoes on anchor pins and guide pins and lock them by replacing anchor pin spacer washers and C washers.

(b) Replace shoe retracting spring.

Pliers, spring, special

Clip one end of spring onto upper guide pin slot of forward shoe, stretch spring with pliers, and clip other end of spring onto upper guide pin slot of reverse shoe (fig. 83). Remove wheel cylinder clamp.

(c) Replace brake drums and wheels (or sprockets).

For front drums follow steps as explained under Front Axle, Section V, TM 9-1710. Replace wheels and lower vehicle. For rear drums follow steps as explained under Rear Axle, Section VI, TM 9-1710.

(2) WHEEL CYLINDER.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{3}{4}$-in.
Wrench, socket, $\frac{3}{4}$-in.
Wrench, socket, $1\frac{5}{16}$-in.

(a) Replace cylinder.

Wrench, socket, $\frac{3}{4}$-in.

Set cylinder links in shoe recesses, and attach cylinder to brake backing plate with cap screws and lock washers.

(b) Replace shoe retracting spring.

See step *(b)* in paragraph (1) *(b)*, above.

(c) Reconnect brake hose.

Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{3}{4}$-in.
Wrench, socket, $1\frac{5}{8}$-in.

Each rear brake hose can be connected directly to its fitting. Each front brake hose must first be connected to its cylinder fitting and then to its coupling at the frame. Tighten down hose clip nuts at steering knuckle plate, and replace engine protecting armor plate.

(d) Replace front brake drum and wheel or rear drum and sprocket.

See step *(c)* in paragraph (1) *(c)*.

(e) Bleed lines.

Follow steps *(a)* through *(j)* as explained in paragraph 26*d* (2), above.

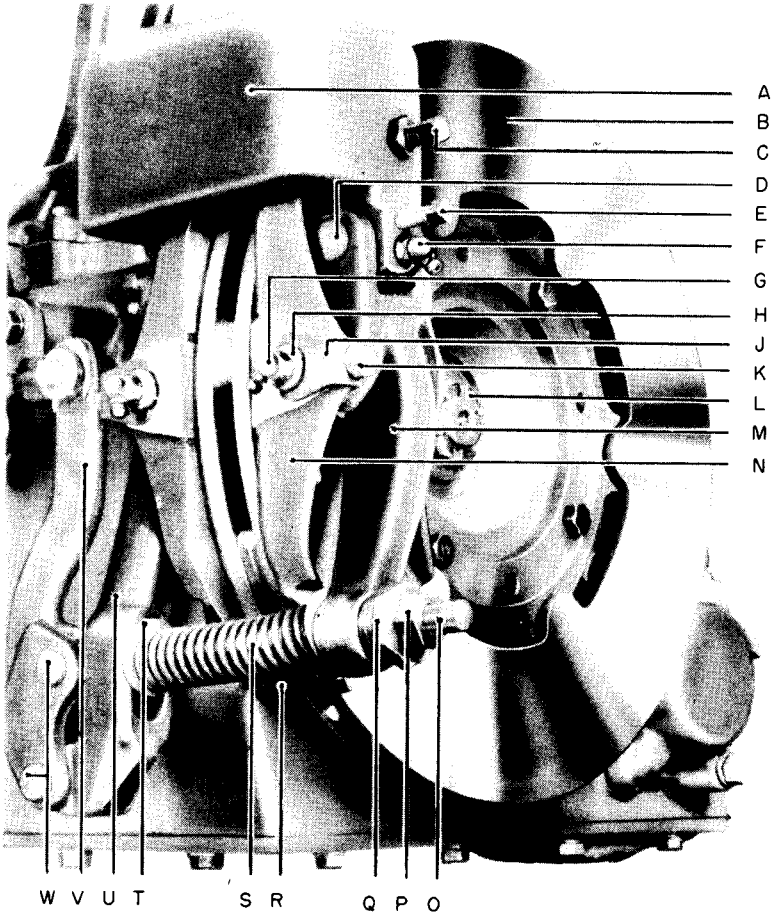
28. DRIVE SHAFT BRAKE.

a. Description (fig. 91). This is a Tru-Stop, two-shoe ventilated disk type, operating on disks mounted on the companion flange of the propeller shaft at the rear of the transfer case.

(1) CONSTRUCTION.

(a) The polished steel brake disk assembly is mounted on the rear propeller shaft companion flange to the rear of the transfer case and is held in place by bolts, nuts, and cotter pins. The brake anchor bracket straddles the disk assembly at its upper left side and is bolted to the rear of the transfer case by three cap screws and lock washers. The upper ends of the front and rear brake shoe lever arms are yokes which fit over the lower extremities of the anchor bracket and are held in place by anchor pins which pass through the yoke eyes and companion holes drilled through the bracket. The anchor pins are grooved at the center so that the screws, threaded into the anchor bracket at right angles to

BRAKE SYSTEMS



A - BRACKET - C85596
B - DISC, ASS'Y - C85636
C - SCREW, SET - A214654
NUT, LOCK - A186558
D - PIN - A214652
E - SCREW, SET - A214649
F - FITTING - CLDX5M
G - FITTING - CLDX5M
H - PIN - A214647
J - RETAINER - A214655
K - SCREW, CAP - A214857
WASHER, LOCK - BECXIH
L - FLANGE - B184285
M - ARM - A214659
N - SHOE - A214661
O - ROD - A214656
P - NUT - BBBXIE
Q - NUT - A214657
R - SPRING - A167466
S - SPRING - A214648
T - WASHER - BEBXICP
U - ARM - A214660
V - LEVER - A214658
W - PIN - BFFXIF
PIN, COTTER - BFAXIDF

RA PD 3541 A

Figure 91—Drive Shaft Parking Brake Assembly—Installed

the pins, fit into these grooves and thereby lock the pins in place. The lever arms pivot on these pins and lubrication is obtained through fittings which are threaded into the anchor bracket just below the locking screws.

(b) The brake shoes straddle the lever arms and are held in place by pins which pass through the shoes and arms. The shoes swivel on these pins and are held in place by means of retainers which fit into grooves cut close to the outside ends of the pins. The retainers are bolted to the brake shoes by cap screws and lock washers. The brake linings are riveted to the shoes and are held against the brake disks by a connecting spring at the bottom of the shoes and adjusting set screws at the top.

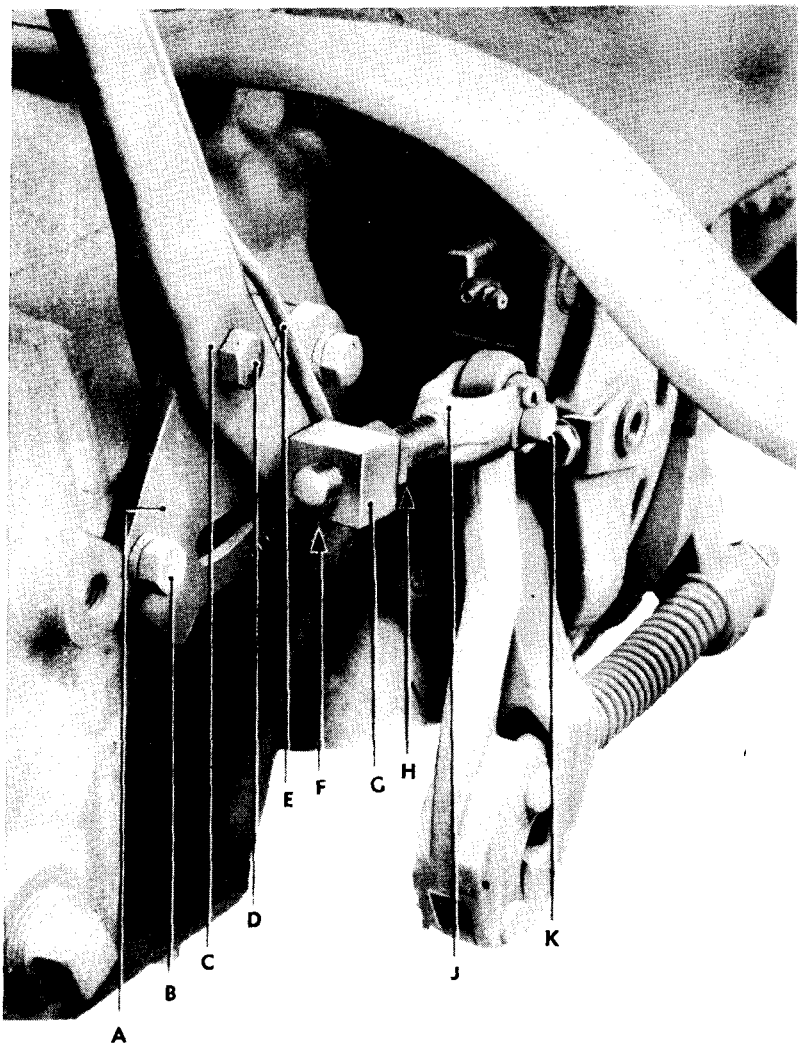
(c) The operating lever tie rod is threaded at one end and has a flattened eye at the other. The eye sets into the upper clevis of the operating lever and is held by a clevis pin and cotter pin. The rod then passes through the slotted hole in the front brake shoe lever arm and through the rear lever arm, and is held by a spherical nut and a lock nut. The brake lever arm release spring with a thrust washer at each end is carried by the tie rod between the front and rear brake lever arms.

(d) The clevis at the bottom of the operating lever straddles the tang at the bottom of the front brake lever arm, and the lever is attached to the arm at this point by a clevis pin and cotter pin. The top of the operating lever sets into the brake pull rod yoke end and is held by a clevis pin and cotter pin. The opposite end of the pull rod is threaded into the brake lever block and is held fast by a lock nut. The lever block has a rod end which passes through the bottom of the lever and the slot in the quadrant, and is held to the lever by a washer and cotter pin.

(e) The brake lever has a forked end at the bottom which straddles the quadrant and is bolted to it by means of a screw, nut, and cotter pin (fig. 92). The quadrant is attached to the left side of the transfer case by means of two cap screws and lock washers. The bottom of the quadrant has teeth cut into it to mate with the pawl, which is attached to the bottom of the brake lever by a clevis pin and cotter pin. The pawl is actuated by the pawl rod which passes up along the rear of the brake lever and through the handle where it is held by a spring, a button, and pin.

(2) OPERATION. When the brake lever is in its released position the lever arm release spring spreads the lever arms and holds the shoes away from the brake disks. When any braking is desired, the brake lever is pulled back at the top, and the bottom moves forward. The pawl moves forward with the bottom of the lever arm, slipping over the quadrant teeth until the desired amount of braking is reached, at which time the

BRAKE SYSTEMS



A — QUADRANT - B184296
B — BOLT - BANX1CC; WASHER, LOCK - BECX1K
C — LEVER, ASS'Y - D48163
D — SCREW - A214872; NUT - A214869; PIN, COTTER - BFAX1CE
E — ROD - B184297

RA PD 56196

F — PAWL - A214854; PIN - A226017; PIN, COTTER - BFAX1CD
G — BLOCK - A214651; WASHER - BEBX1CK; PIN, COTTER - BFAX1CD
H — NUT - BBBX1E
J — ROD - A214650
K — PIN - BFFX1F; PIN, COTTER - BFAX1DF

Figure 92—Drive Shaft Parking Brake Linkage—Installed

brake lever is released and the pawl engages with the quadrant teeth and holds the brake lever in the desired position. The forward movement of the bottom of the brake lever carries with it the lever block and the pull rod which is held in the block. The pull rod pulls the top of the operating lever forward. This causes the lever to pivot at the point where it is attached to the front brake shoe lever arm, and at the same time it pushes the arm toward the rear and pulls the operating lever tie rod forward against the resistance of the release spring. The rearward motion of the bottom of the front lever arm makes the arm pivot on the pin which holds it to the anchor bracket, and it brings the front brake shoe in contact with the front brake disk. At the same time, the forward pull of the tie rod causes the rear brake lever arm to pivot on its holding pin and bring the rear brake shoe in contact with the rear brake disk. In this manner, both brake shoes contact the disks at the same time and with an equal amount of pressure. To release the brake shoes, depress the pawl rod button at the top of the brake lever and at the same time apply a slight backward pressure on the lever to aid the pawl in dropping away from the sector teeth. Push the top of the lever forward. This will release the mechanism, permitting the release spring to separate the brake shoes.

(3) SPECIFICATIONS.

Make American Cable Co.	Ordnance No. D48120
Type Two-shoe	White No. 1376159
Model TRU-STOP 40S-004-013	Autocar No. 10W0990
Manufacturer's No. TRU-40-S-164013	Diamond T No. N1494

Disk diameter 14 in.
Hand brake shoe
Size 9½ in. x 3 in.
Lining area 45 sq. in.

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) BRAKE WILL NOT HOLD.	
Shoes improperly mounted.	Check shoes and connections, and readjust.
Linings worn.	Replace with new linings.
Shoes out of adjustment.	Readjust.
(2) BRAKE DRAGS.	
Release spring broken.	Replace with new spring.
Release spring taken permanent set.	Replace with new spring.
Operating lever sticks.	Lubricate pivot pin.

Symptom and probable cause	Probable remedy
(3) BRAKE LEVER WILL NOT HOLD IN "ON POSITION".	
Worn or broken pawl teeth.	Replace pawl.
Worn or broken quadrant teeth.	Replace quadrant.

c. Removal of Assembly.

(1) DISK BRAKE. The disk brake is not usually removed as a unit but is partially disassembled while still on the vehicle. See paragraph d (1), below.

(2) BRAKE LEVER.

Pliers
Wrench, socket, $\frac{9}{16}$-in.

(a) Disconnect yoke end pull rod from operating lever.

Pliers

Set brake lever in its released position. Then remove pull rod clevis pin, cotter pin, and push out clevis pin.

(b) Remove lever assembly.

Wrench, socket, $\frac{9}{16}$-in.

Take off two cap screws and lock washers holding quadrant to transfer case, and lower assembly to floor.

d. Disassembly of Components.

(1) DISK BRAKE (fig. 93).

Hammers
Pliers
Punch, rivet
Wrench, open-end, $\frac{5}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{3}{4}$-in.
Wrench, open-end, $1\frac{1}{4}$-in.
Wrench, socket, $\frac{1}{2}$-in.
Wrench, socket, $\frac{9}{16}$-in.

(a) Remove brake disk assembly.

Pliers
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.

Disconnect rear propeller shaft at transfer case flange yoke by removing eight bolts, nuts, and cotter pins. This will also release disk assembly, and it can be lowered to floor.

(b) Disconnect operating lever arm at pull rod.

Pliers
Wrench, open-end, $\frac{3}{4}$-in.
Wrench, open-end, $1\frac{1}{4}$-in.

Loosen operating lever tie rod lock nut and spherical nut. Remove cotter pin from pull rod yoke end clevis pin and pull out clevis pin.

(c) Disconnect brake shoe lever arms at anchor bracket.

Wrench, open-end, $\frac{5}{16}$-in.

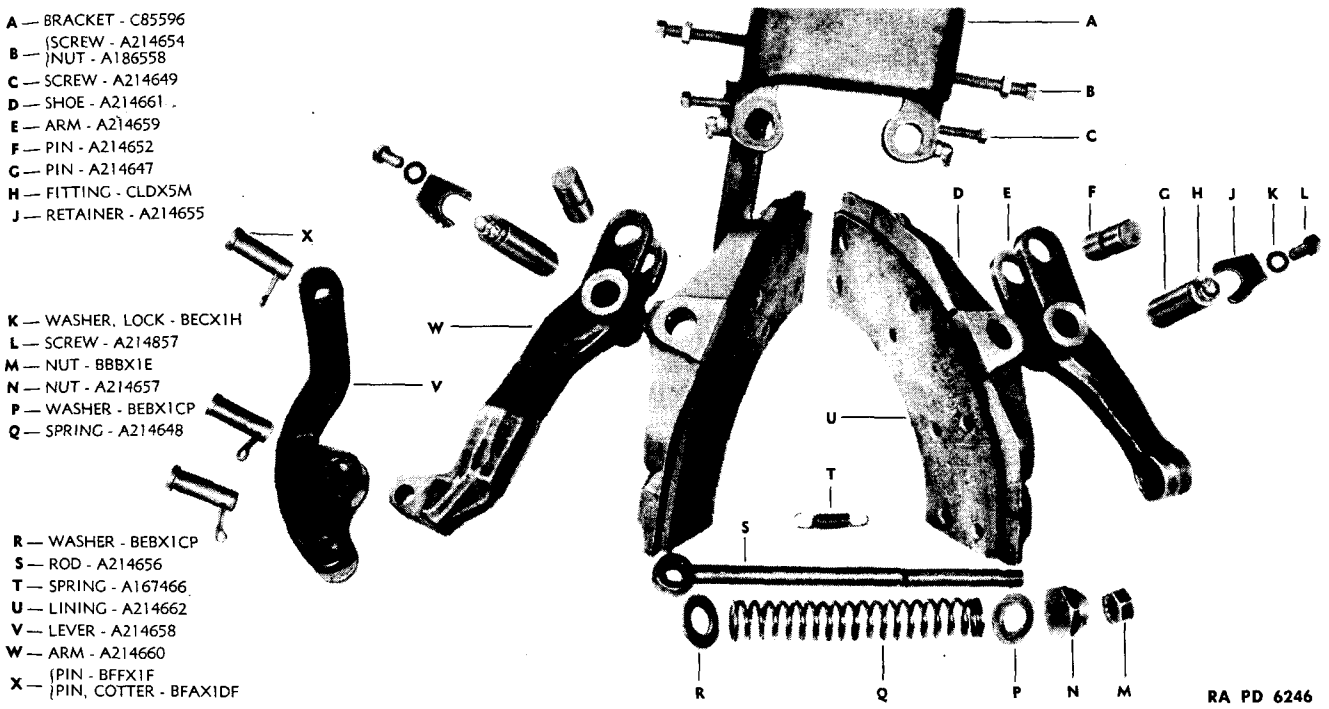


Figure 93—Drive Shaft Parking Brake—Exploded

BRAKE SYSTEMS

Free lever arm anchor pins by turning locking screws until they are out of anchor pin grooves. Remove anchor pins and lower brake shoes, lever arms, tie rod, and operating lever as a unit.

(d) Remove the anchor bracket.

Remove one long cap screw and two short cap screws holding bracket to transfer case, and lower bracket.

(e) Remove the rear lever arm and brake.

Wrench, open-end, 3/4-in. Wrench, open-end, 1 1/4-in.

Take off brake shoe spring, tie rod lock nut, and spherical nut. Then pull off lever arm and brake shoe assembly; release spring and spring washers.

(f) Disconnect operating lever from front brake shoe lever arm and tie rod.

Pliers

Remove lever clevis pin cotter pin. Repeat this operation for tie rod clevis pin, and separate tie rod and operating lever.

(g) Separate brake shoes from lever arms.

Wrench, socket, 1/2-in.

Remove brake shoe pin retainer screws, lock washers, and retainers. Pull out brake shoe pins, and separate shoe assemblies from lever arms.

(h) Remove linings from brake shoes.

Hammer Punch, rivet

Punch out rivets and separate linings from shoes.

(2) BRAKE LEVER.

Hammer
Pliers
Punch

Wrench, open-end, 9/16-in.
Wrench, open-end, 13/16-in.
Wrench, socket, 9/16-in.

(a) Remove yoke end pull rod.

Wrench, open-end, 13/16-in.

Remove clevis pin and cotter pin from pull rod yoke end and mark position of lock nut on pull rod to facilitate assembly. Then loosen nut and turn pull rod out of lever block.

(b) Remove lever block.

Pliers

Pull out lever block cotter pin, and remove washer and block.

(c) Remove pawl.

Pliers

Pull out cotter pin and clevis pin which hold pawl to lever. Then twist pawl and release it from pawl rod.

(d) Remove quadrant.

Pliers

Wrench, open-end, 9/16-in. Wrench, socket, 9/16-in.

Pull out cotter pin, and remove nut and screw holding quadrant to lever. Then slip quadrant out of lever fork.

(e) Remove pawl rod from lever handle.

Hammer Punch

Drive out pawl rod button pin, remove button and spring, and pull out pawl rod.

e. Maintenance and Adjustments.

(1) Brake shoes normally must be parallel to and not touching the disk when the brake is in the released position. If they are found to be out of parallel, adjust by turning the top adjusting screws at the front and rear of the anchor bracket.

(2) Inspect linings, and if they are worn close to the rivets, replace with new linings of the same make, as follows:

(a) Remove old linings from shoes by following steps *(b)*, *(c)*, *(g)*, and *(h)* as explained in paragraph **d** (1), above.

(b) Set the new linings on the brake shoes, and hold them in place with a suitable clamp.

(c) Rivet the linings to the shoes with the correct type of rivets. Never use aluminum rivets.

(d) Remove the high spots and burs around the rivet holes with a fine file. Do not use emery paper.

(e) Reinstall the brake shoes as explained under Reassembly of components, paragraph **f**, below.

(3) When the linings are worn so that the brake will not hold, or after relining the shoes, adjustment should be made as follows:

(a) Release the hand brake lever fully, and disconnect the pull rod at the operating lever by removing the cotter pin and clevis pin.

(b) Tighten operating lever tie rod spherical adjusting nut so that the lever arm release spring on the tie rod will draw the operating lever firmly against the front brake lever arm.

(c) Insert a $\frac{1}{32}$-inch shim or feller gage between the front shoe lining and disk (fig. 94).

(d) Adjust hand lever pull rod to maintain this clearance, and reconnect pull rod to operating lever by replacing clevis pin and cotter pin.

(e) Adjust rear shoe for the same clearance with the disk and tighten locking nut on rear end of tie rod to keep this spacing (fig. 95).

(f) Make sure that the spring connecting the lower ends of the brake shoes is in place, and adjust the top screws at the front and rear of the anchor bracket to make shoes and linings parallel to disk.

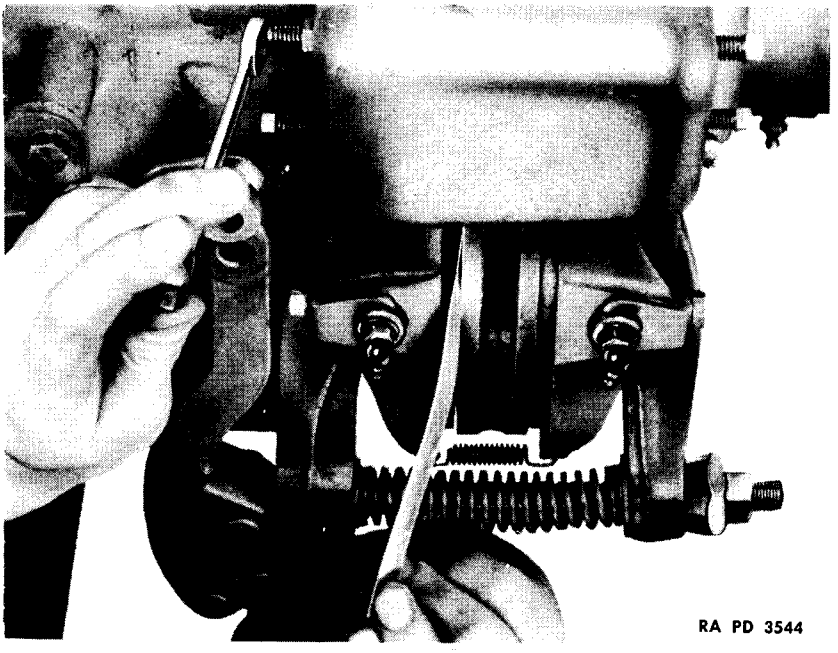


Figure 94—Drive Shaft Brake Front Shoe Adjustment

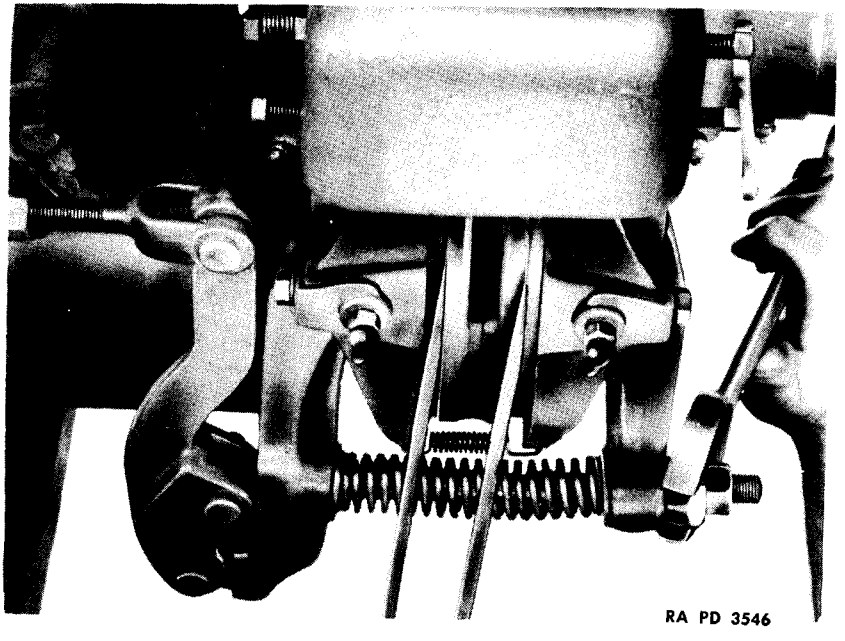


Figure 95—Drive Shaft Brake Rear Shoe Adjustment

(g) Remove shims.

(4) Inspect all clevis and anchor pins, and replace any that are badly worn or damaged.

(5) Check lever arm release spring, shoe connecting spring, and pawl rod spring for breaks or signs of permanent set, and replace, if necessary.

(6) Inspect pawl and quadrant for worn or broken teeth, and replace with new parts, if required.

(7) SERVICE DATA.

Brake adjustment
Clearance, linings to disk $\frac{1}{32}$ in.
Brake release spring
Free length 4¾ in.
Pounds pressure at 4 $\frac{3}{16}$ in. 60 lb

f. Reassembly of Components.

(1) DISK BRAKE (fig. 93).

Pliers
Wrench, open-end, $\frac{5}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, ¾-in.
Wrench, open-end, 1¼-in.
Wrench, socket, ½-in.
Wrench, socket, $\frac{9}{16}$-in.

(a) Fasten linings to shoes.

Follow steps *(b)* through *(d)* as explained in paragraph e (2), above.

(b) Attach anchor bracket to transfer case.

Hold bracket in place and fasten it with cap screws and lock washers.

(c) Attach brake shoe lever arms to anchor bracket.

Wrench, open-end, $\frac{5}{16}$-in.

Replace lever arm anchor pins, and turn locking screws until pins are locked in place.

(d) Attach brake shoe assemblies to lever arms.

Wrench, socket, ½-in.

Straddle lever arms with brake shoes, and replace pins, pin retainers, and retainer holding screw and lock washer.

(e) Replace disk assembly.

Pliers
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.

Slip disk between brake shoes and hold it in its normal running position. Then bring propeller shaft into position, and insert bolts through shaft flange, disk, and companion flange at rear of transfer case. Replace bolt nuts and cotter pins.

(f) Attach tie rod to operating lever.

Pliers

Slip tie rod eye into operating lever clevis, and replace clevis pin and cotter pin.

(g) Replace operating lever and tie rod.

Pliers
Wrench, open-end, 1¼-in.
Wrench, open-end, ¾-in.

Slip tie rod through front lever arm, and install release spring front washer, spring, and rear washer onto rod. Then push rod through rear lever arm, and start spherical nut and lock nut onto threaded portion of rod. Attach lower part of operating lever clevis to front lever arm by replacing clevis pin and cotter pin.

(h) Adjust shoes.

Follow steps *(b)* through *(g)* as explained in paragraph e (3), above.

(2) BRAKE LEVER (fig. 92).

File, fine
Hammer
Pliers
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{3}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.

(a) Replace pawl rod.

File, fine
Hammer

Insert pawl rod into lever handle, install spring and button, and stake assembly with button pin. File end of pin flush with handle.

(b) Replace quadrant.

Pliers
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.

Slip quadrant into fork at bottom of lever, and fasten by replacing screw, nut and cotter pin.

(c) Install pawl.

Pliers

Hook pawl onto bottom of pawl rod, and fasten it to bottom of lever with clevis pin and cotter pin.

(d) Replace lever block.

Pliers

Insert lever block rod end through lever fork and slot in quadrant, and replace holding washer and cotter pin.

(e) Replace yoke end pull rod.

Pliers
Wrench, open-end, $\frac{3}{16}$-in.

Turn threaded end of pull rod into lever block until mark made at disassembly is reached, and then lock rod in this position with its lock nut. Connect yoke end to operating lever by replacing clevis pin and cotter pin.

g. Installation of Assembly.

(1) DISK BRAKE. The disk brake is not removed as a unit and therefore is installed on vehicle as it is being assembled. See preceding *f* (1), above.

(2) BRAKE LEVER.

Pliers — Wrench, open-end, $\frac{9}{16}$-in.

(a) Attach lever to transfer case.

Wrench, open-end, $\frac{9}{16}$-in.

Bolt assembly in position by fastening quadrant to transfer case with cap screws and lock washers.

(b) Connect pull rod yoke end to top of operating lever.

Pliers

Replace clevis pin through yoke end and lever, and lock in place with cotter pin. Check brake adjustment.

29. TRAILER BRAKE CONTROLLER (fig. 96).

a. Description.

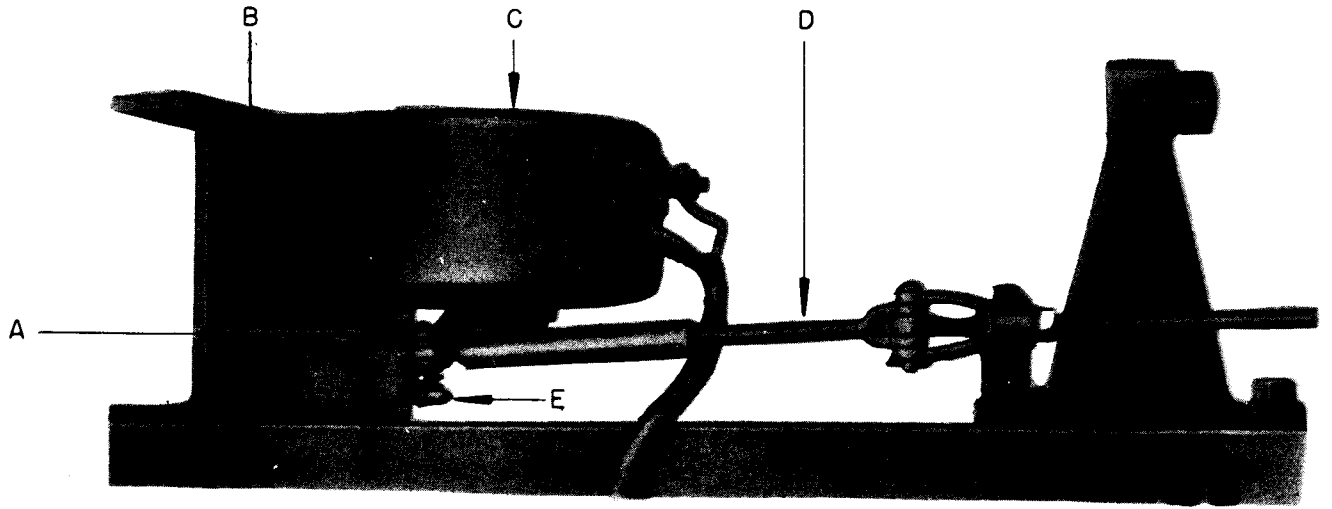
(1) The controller is mounted on the outer left side of the main chassis frame and is readily accessible from under the running board. It is connected to the main brake pedal with suitable linkage, the forward clevises of which are adjustable.

(2) The controller is used in conjunction with a load control (fig. 97) to supply current to the electric brake equipment on various trailer units pulled by the half-track cars. The controller supplies an electric current flow proportional to the movement of the main brake pedal, so that the braking effect of both the car and the trailer unit are approximately proportional to the weight of the two vehicles. The controller can be used with either a 12-volt or 6-volt source of electrical energy. The load control is mounted on the instrument panel and has a radio-type control knob, together with a small instruction dial, so that additional adjustments to the current flow to the trailer unit brakes can be made.

(3) OPERATION. Turning the load control knob until the arrow lines up with the spot adjacent to the word "heavy" gives all the braking forces available. Turning the knob until the arrow lines up with the spot adjacent to the word "light" reduces the maximum current flow about one-half. The knob can be set any place between the two extremes to secure the proper relation between the brakes on the car and trailer unit.

b. Maintenance and Adjustments.

(1) A rod shift device is provided so that extreme variation in the relative total movement of the pedal rod and controller lever may be



A — PLUNGER, ASS'Y - A215189

B — BOLT - BAOX1CC
WASHER, LOCK - BECX1K
NUT - BBBX1C

C — CONTROL, ASS'Y - D48149

D — OVERTRAVEL, ASS'Y - B184406

E — KNOB - A215195
PIN - BFAX1BD

RA PD 6291

Figure 96—Trailer Brake Controller—Installed

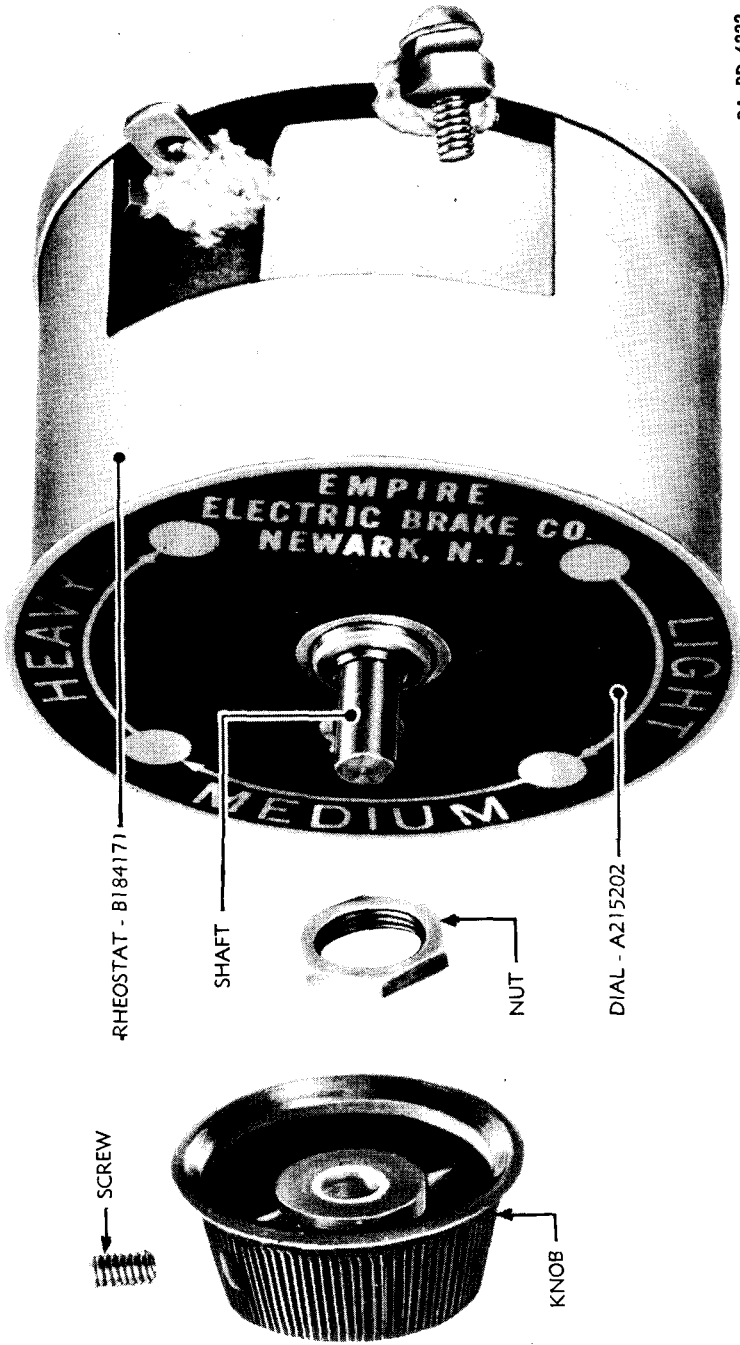


Figure 97—Trailer Brake Control—Exploded

obtained (fig. 98). The shift is made by pushing the knob in toward the controller housing until the mechanism can be moved to other positions within the lever slot. Ordinarily the controller lever and rod motion are correct when the shift assembly is approximately centered on the lever. Setting the shift in the outer position causes a longer rod motion for a given lever motion. Setting the shift in the inner position causes a contrary condition. Adjustment of the rod clevis on the brake pedal rod should be such that from $\frac{1}{8}$- to $\frac{3}{16}$-inch compression of the rear overtravel spring occurs when the brake pedal is back fully released and the controller lever is in its full off position. Measure by watching the movement of the overtravel clevis rod into the spring casing just as the controller lever moves to the full off position.

(2) The brake pedal motion is dependent on the brake adjustment. Since the motion of the trailer brake controller is linked to the motion of the brake pedal, trailer brake action is also dependent on the adjustment of the prime mover brakes. For this reason, brakes on the halftrack should not be adjusted too tightly, as such a condition will result in too heavy brake application.

(3) If trailer brakes do not operate, use ammeter in brake wire circuit to test. There should be not less than two amperes per brake at full application with load control set on "heavy".

(a) If no current is detected, trace wires to battery and load control for break.

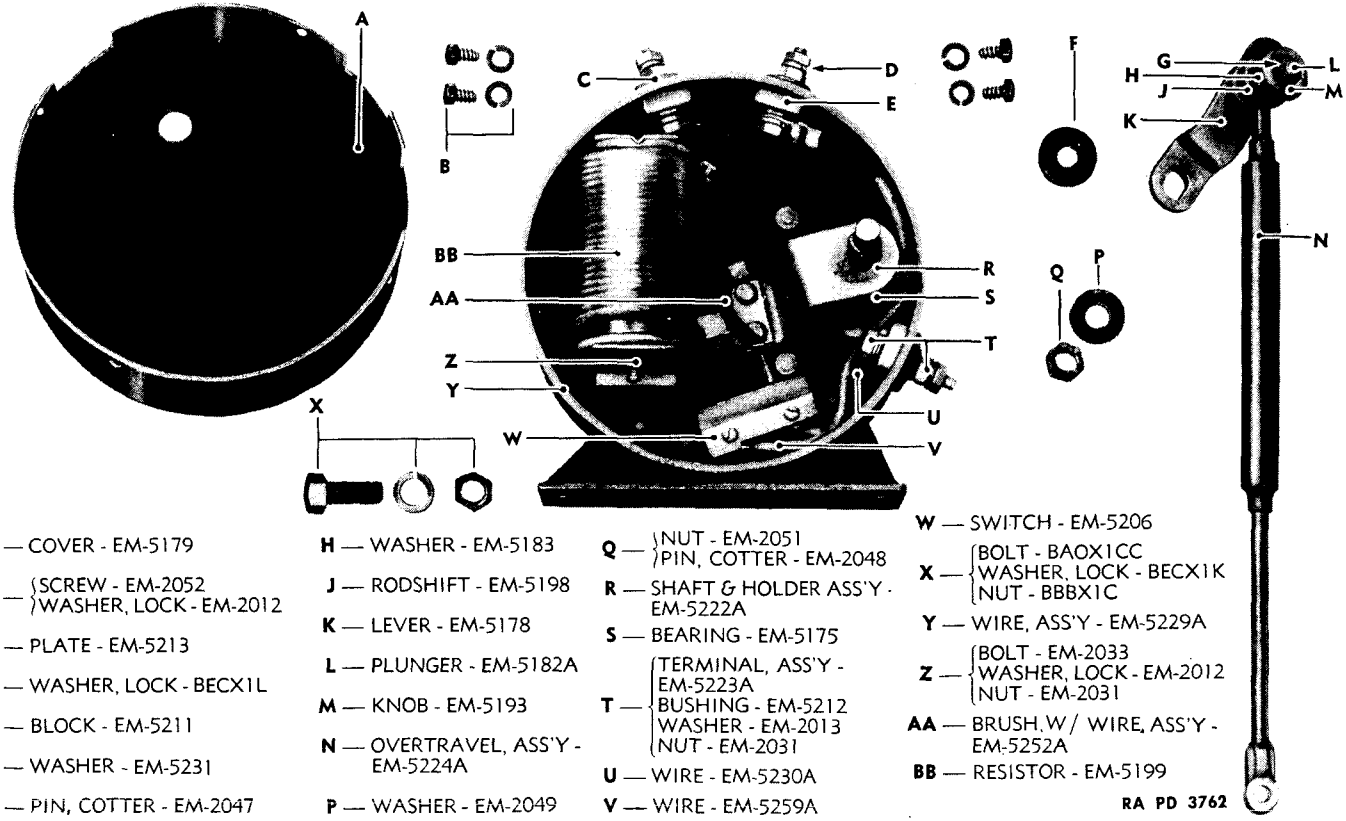
(b) If wires are intact, use jumper and bypass controller from battery.

(c) Remove cover and short circuit coil (across leads).

(d) Check leads in box for broken brush wire or poor contact of brush to resistor. If brake controller circuits are broken, full on position will still give braking action because in the full on position, there is a direct circuit through unit.

(e) Check alinement of brush holder and brush, and straighten if necessary. They may be bent by too much torque application when tightening nut.

CAUTION: When working on or repairing unit, disconnect wires to battery to prevent short circuiting and ruining coil and ammeter.



A — COVER - EM-5179

B — {SCREW - EM-2052 / WASHER, LOCK - EM-2012

C — PLATE - EM-5213

D — WASHER, LOCK - BECX1L

E — BLOCK - EM-5211

F — WASHER - EM-5231

G — PIN, COTTER - EM-2047

H — WASHER - EM-5183

J — RODSHIFT - EM-5198

K — LEVER - EM-5178

L — PLUNGER - EM-5182A

M — KNOB - EM-5193

N — OVERTRAVEL, ASS'Y - EM-5224A

P — WASHER - EM-2049

Q — {NUT - EM-2051 / PIN, COTTER - EM-2048

R — SHAFT & HOLDER ASS'Y - EM-5222A

S — BEARING - EM-5175

T — {TERMINAL, ASS'Y - EM-5223A / BUSHING - EM-5212 / WASHER - EM-2013 / NUT - EM-2031

U — WIRE - EM-5230A

V — WIRE - EM-5259A

W — SWITCH - EM-5206

X — {BOLT - BAOX1CC / WASHER, LOCK - BECX1K / NUT - BBBX1C

Y — WIRE, ASS'Y - EM-5229A

Z — {BOLT - EM-2033 / WASHER, LOCK - EM-2012 / NUT - EM-2031

AA — BRUSH, W/ WIRE, ASS'Y - EM-5252A

BB — RESISTOR - EM-5199

Figure 98—Trailer Brake Controller—Exploded

Section VII

COOLING SYSTEM

	Paragraph
Description	30
Trouble shooting	31
Radiator	32
Water pump and oil cooler	33

30. DESCRIPTION (fig. 99).

The water cooling system consists of a thermostat, radiator, fan, shroud, centrifugal water pump, and connecting pipes and hoses. The radiator is located at the front of the engine and is connected to the engine head liquid outlet fitting at the top and the oil cooler at the bottom by means of pipes with short rubber hose connections at each end. The engine head fitting is also connected to the top of the oil cooler by means of a short piece of rubber hose, and the thermostat is located inside this fitting. The water pump is bolted to the front of the engine so that its outlet coincides with the water inlet located in the front of the engine block. The pump inlet is connected to the oil cooler outlet by means of a short pipe with rubber hoses at each end. The fan is bolted to the front of the water pump hub and is enclosed by the shroud which is attached to the radiator. The pump driving sheaves are part of the pump assembly and are driven by two V-belts which are driven by the engine crankshaft. The system may be drained by opening drain cocks located: (1) at the bottom of the water pump, (2) at the center left side of the cylinder block (in front of starter), (3) in the radiator outlet pipe, and (4) by removing plug at right rear side of the cylinder block (in rear of manifold).

a. Operation.

(1) The pump forces the liquid into the cylinder block around the cylinders and upward through the passages and nozzles into the cylinder head. The liquid then continues into the top of the radiator, down through the radiator tubes, out through the bottom pipe, and back through the oil cooler to the pump inlet. Air, rushing through the radiator fins and around the tubes, cools the liquid as it descends through the tubes and is then blown back over the engine by the fan.

(2) During the warm-up period, the thermostat is closed and by-passes the liquid so that the circulation is through the block to the head and back to the pump inlet. This cuts out the cooling effect of the radiator and allows the liquid and engine to heat up quickly until the temperature reaches 155 F, at which point the thermostat starts to open, allowing the liquid to go to the radiator.

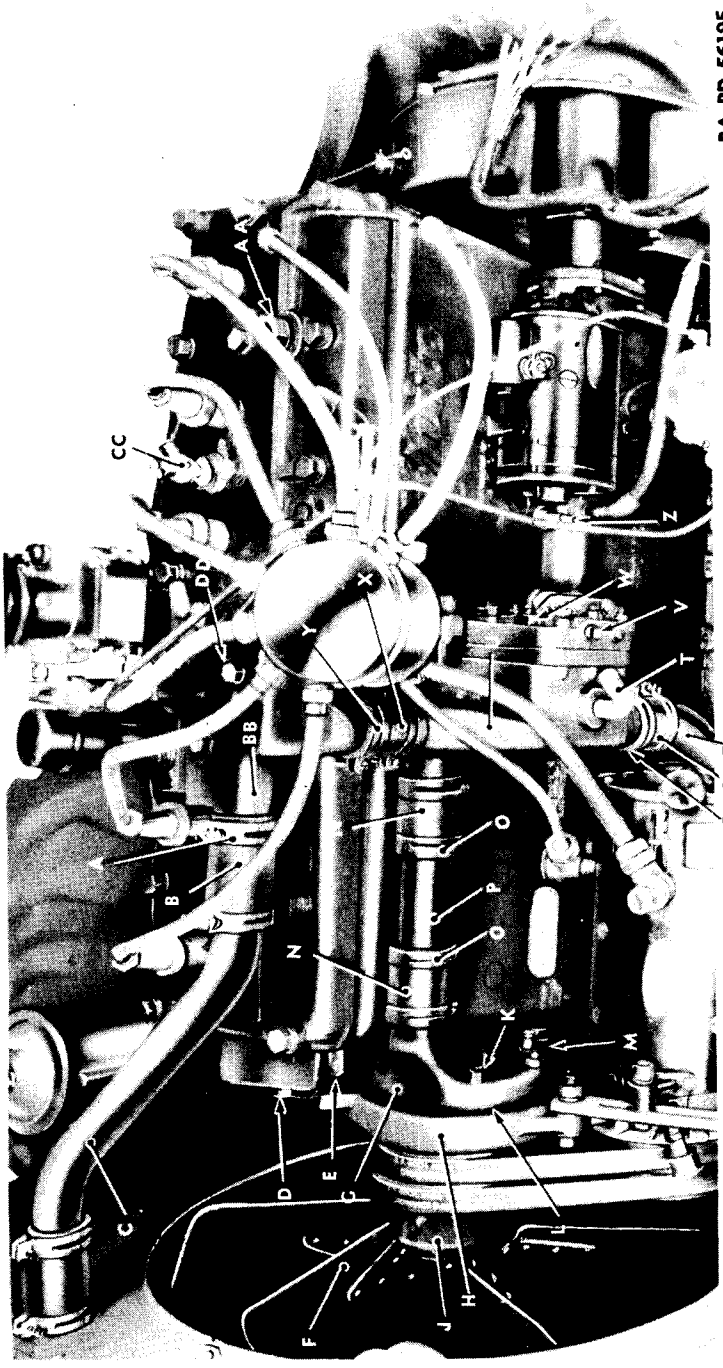


Figure 99A—Cooling System—Installed

A — CLAMP - A167616

B — HOSE - A167716

C — PIPE - D48133

D — SCREW, CAP - A215108
SCREW, CAP - BCAX1DP
WASHER, LOCK - BECX1L

E — GASKET - B184392

F — BLADE, ASS'Y - C85589

G — COVER - C85700

H — BODY, ASS'Y - C85699

J — PULLEY - C85701

K — STUD - A215167
NUT - A215180
WASHER, LOCK - BECX1K

L — GASKET - B184373

M — COCK, ASS'Y - A215165

N — HOSE - A214336

O — CLAMP - A214346

P — PIPE - A215086

Q — CLAMP - A214346

R — HOSE - A214336

S — PIPE, ASS'Y - D48125

T — ELBOW - B1-26405

U — HOUSING, ASS'Y - C85676

V — BRACKET - D48181

W — NUT - BBBX1C
WASHER, LOCK - BECX1K

X — HOSE - A215087

Y — CLAMP - A167616

Z — COCK, ASS'Y - A214350

AA — ADAPTER - A215070

BB — HOUSING (UPPER) - D48178

CC — COCK, ASS'Y - A225862
BUSHING - A175492

DD — SCREW, CAP - A215069
WASHER, LOCK - BECX1K

RA PD 3549C

Figure 99B—Cooling System Nomenclature

b. Specifications.

Cooling capacity (quarts)	26
Water pump	
Type	Packless
Location	Left front side of cylinder block
Drive	Double V-belt
Impeller location	Pump body
Bearings	Ball
Fan	
Make	Service Products Corp.
Number	C-85589-SP
Diameter	19 in.
Number of blades	6
Fan belts	
Make	Davis Trans. Co.
Type	VEE
Width	7/8 in. x 38
Length	49 in.
Radiator core	
Make	Modine
Numbers	AD3643
Type	Fin and tube
Frontal area	675 sq in.
Thickness	3 in.
Thermostat	
Make	Fulton Syphon
Type	Bellows
Starts to open at	155 F
Fully opened at	175 F

31. TROUBLE SHOOTING.

Symptom and probable cause	Probable remedy
a. Overheating	
Radiator dirty inside or out.	Clean radiator thoroughly.
Dirty water.	Drain and refill with clean water.
Engine timing wrong.	Time engine correctly.
Fan belts slipping on fan pulley.	Take up belt slack.
Thermostat not functioning correctly.	Replace with new one.
Restriction in system.	Clean system to remove restriction.
Air being drawn into system.	Tighten hose connections.
b. Overcooling.	
Thermostat remains open.	Replace thermostat.
c. Loss of Cooling Liquid.	
Loose hose connections.	Tighten all connections.
Damaged hose connections.	Replace damaged hose.
Leaking water pump.	Replace pump.
Leaks in radiator core.	Remove core and repair leaks.
Loose or open drain cocks.	Check and tighten.

32. RADIATOR.

a. Description (figs. 100, 101, and 102). The radiator is of the two-tank, fin and tube type.

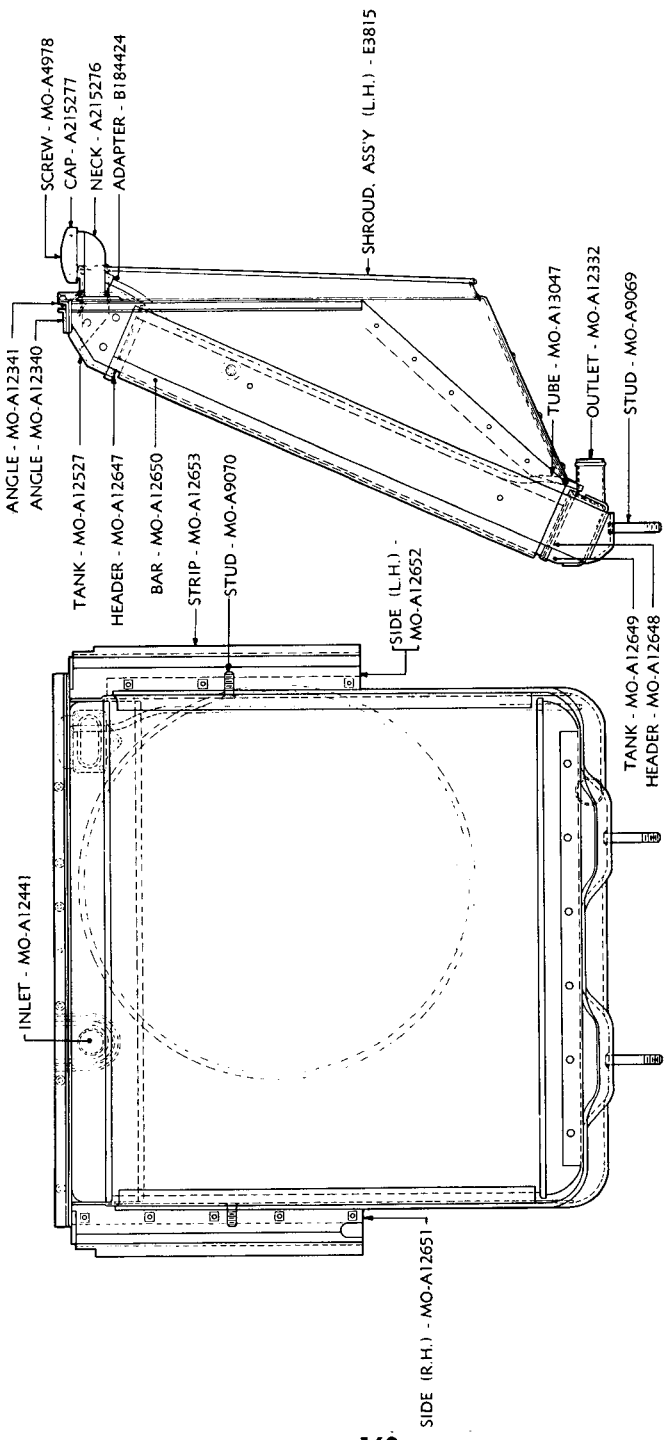


Figure 100—Radiator Assembly—Sectionalized

(1) CONSTRUCTION. The radiator consists of two brass tanks with the core set in between the tanks and the tubes brazed into each tank at their ends. The assembly is reinforced by an angle framework around the outside. The inlet fitting is brazed into the right hand side of the upper tank and the filler neck to the left side. The outlet fitting is brazed into the left side of the lower tank. The filler neck has an overflow pipe welded into it at the top. The shroud is held to the radiator frame by screws. The radiator mounting bolts are welded into the saddle, which in turn is spot-welded to the bottom reinforcing bar. The studs for the side bracing rods are welded into the reinforcing bar at each side of the radiator.

(2) OPERATION. The system is filled with liquid through the filler neck. The liquid comes into the upper tank through the inlet fitting, goes down through the tubes to the lower tank, and out through the outlet fitting. Air rushing through the fins and around the tubes cools the liquid as it runs down through the tubes.

(3) SPECIFICATIONS.

Make Modine	White No. 371631
Type Fin and Tube	Autocar No. 5W350
Manufacturer's No. . . AD-3643	Diamond T No. N22162
Ordnance No. D48100	

b. Removal of Assembly.

Hoist	Wrench, box, $\frac{9}{16}$-in.
Pail, large	Wrench, open-end, ½-in.
Pliers	Wrench, open-end, $\frac{9}{16}$-in.
Screwdriver	Wrench, socket, ¾-in.
Screwdriver, heavy duty	Wrench, socket, $1\frac{3}{16}$-in.

(1) DRAIN RADIATOR.

Pliers
Pail, large

Open drain cock in radiator outlet pipe, and drain liquid into pail or on ground.

(2) REMOVE HOOD.

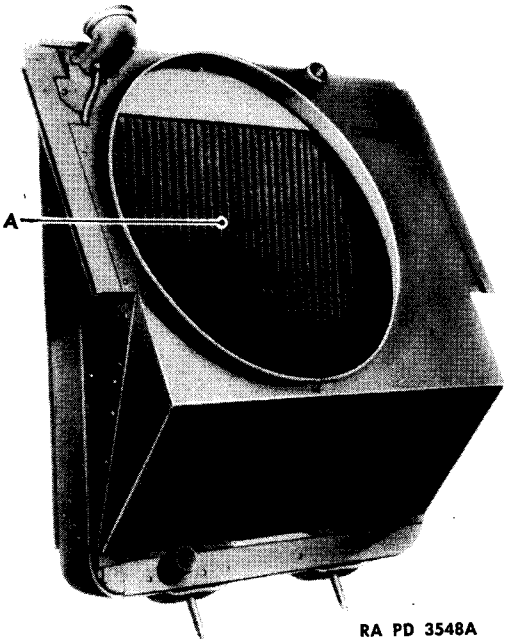
Screwdriver, heavy duty
Wrench, open-end, $\frac{9}{16}$-in.

Remove six screws and nuts holding hood top plate to top of shutter frame and cowl. Lift off hood with hoist and rope, or three men can slide it over front of car.

(3) REMOVE LOUVER ASSEMBLY.

Hoist	Wrench, open-end, ½-in.
Screwdriver, heavy duty	Wrench, open-end, $\frac{9}{16}$-in.
Wrench, box, $\frac{9}{16}$-in.	

COOLING SYSTEM



A — RADIATOR W/SHROUD ASS'Y - D48100
B — SEALING, RUBBER- A214335
C — CAP - A215277
D — NECK - A215276
E — SEALING, RUBBER- A214334
F — INLET - MO - A12441
G — NUT - BBBX1E WASHER, LOCK - BECX1M
H — RODS, STAY- C85517
J — STUD - MO - A9069
K — OUTLET - MO - A12332
L — RODS, STAY- C85516
M — NUT - BBBX1E WASHER, LOCK - BECX1M
N — ADAPTER - B184424

Figure 101—Radiator with Shroud Assembly

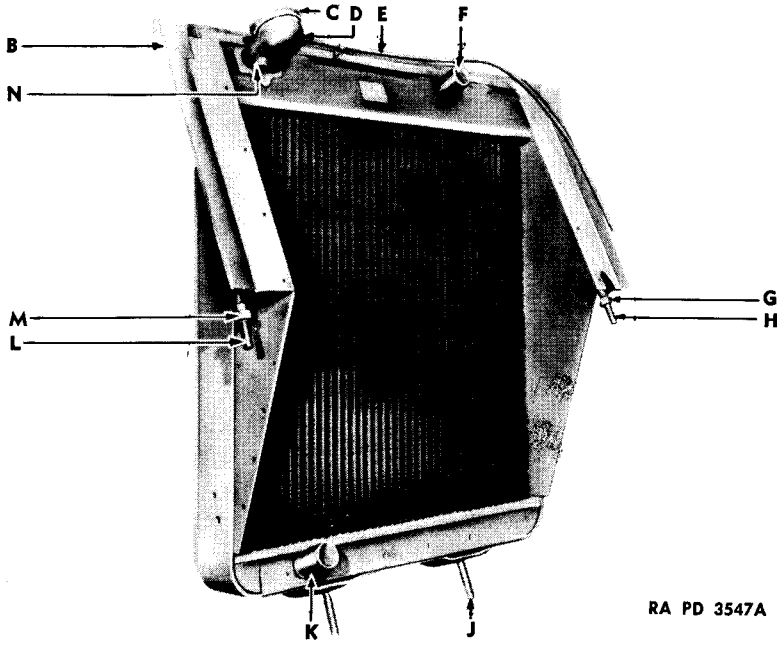


Figure 102—Radiator Assembly

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Remove two screws and nuts holding each louver frame side plate to body side plates. Disconnect louver control on lower right side of radiator. Lift louver and frame assembly straight up and out of vehicle (fig. 103).

(4) DISCONNECT UPPER AND LOWER RADIATOR HOSE CONNECTIONS.
Screwdriver

Unscrew hose clamp bolts, loosen clamps, and pull hoses from inlet and outlet fittings.

(5) DISCONNECT BOTTOM OF RADIATOR FROM FRAME.
Pliers Wrench, socket, ¾-in.

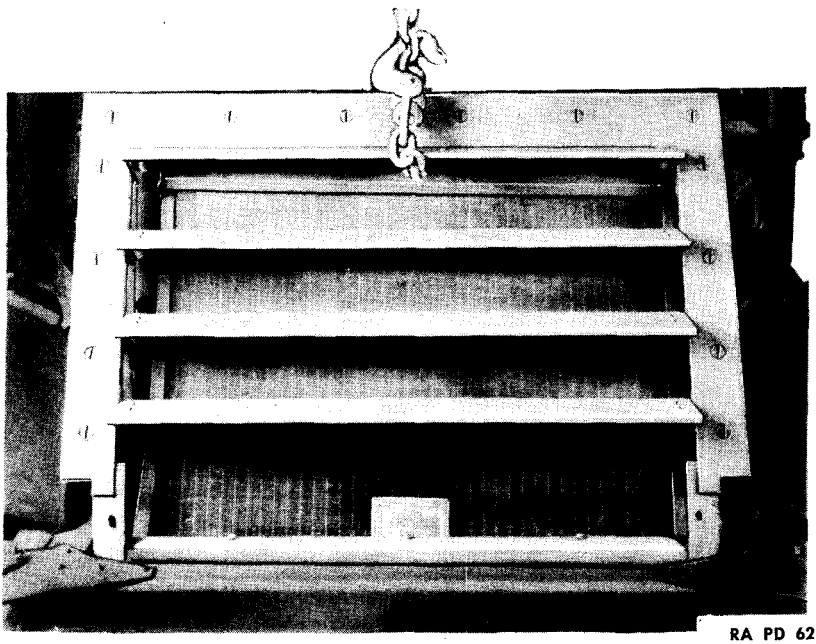
Remove radiator mounting stud cotter pins and nuts, and take off washers, springs, and spring pads.

(6) DISCONNECT STAY RODS AT EACH SIDE OF RADIATOR.
Wrench, socket, $1\frac{3}{16}$-in.

Remove nuts and lock washers holding stays to radiator side studs, and pull stays free of studs.

(7) REMOVE RADIATOR ASSEMBLY.
Hoist

Lift radiator assembly out of frame by pulling up and slightly to front, so that shroud clears fan (fig. 104).



RA PD 6209

Figure 103—Radiator Louver Assembly Removal

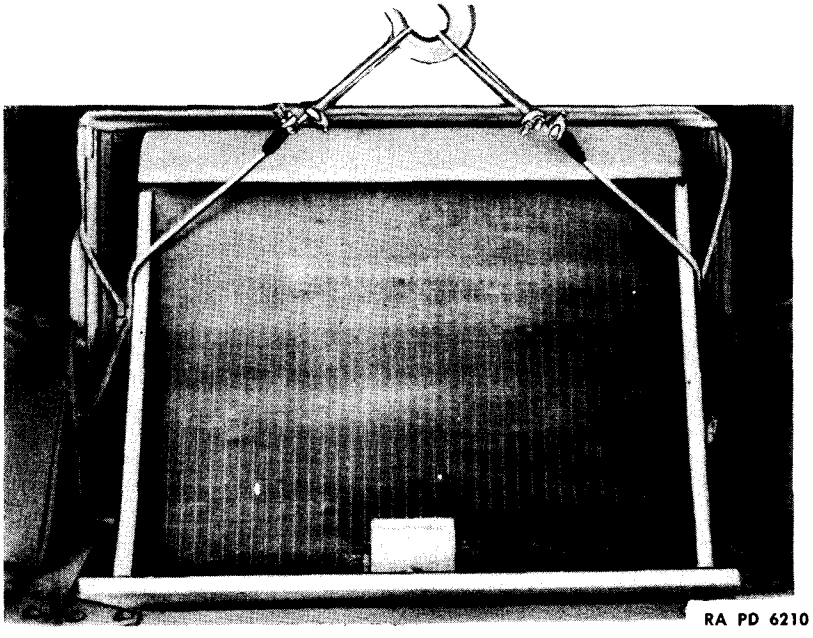


Figure 104—Radiator Removal

c. Disassembly.

Blowtorch — Wrench, open-end, $\frac{5}{16}$-in.
Screwdriver

(1) REMOVE RADIATOR ASSEMBLY. Follow directions in paragraph **b**, above.

(2) REMOVE SHROUD.

Screwdriver — Wrench, open-end, $\frac{5}{16}$-in.

Remove 18 nuts, lock washers, and screws holding shroud to radiator assembly, and lift off shroud.

(3) REMOVE FILLER NECK.

Blowtorch

Heat portion of filler neck, at point of attachment, until solder runs, and then pull off neck.

(4) REMOVE INLET AND OUTLET FITTINGS.

Blowtorch

Follow procedure used in step **c** (3), above.

d. Maintenance and Repairs.

(1) Check the inlet and outlet fittings and the filler neck for damage or breaking-away at the points where they are attached to tanks. If any is apparent, proceed in the following manner:

(a) Remove the fittings as explained in paragraph c, above.

(b) If the fittings are damaged, replace with new ones. Otherwise, remove solder from old fitting.

(c) Solder filler neck and inlet and outlet fittings to tanks.

(2) At least every 20,000 miles, remove radiator core and clean it inside and outside in a cleaning solution. At the same time, examine core for leaks and bent tubes and repair if necessary.

(a) The leaks can usually be repaired by soldering.

(b) Bent tubes can be straightened by pushing a long steel bar through them. This will also clean the tubes, and all tubes should be subjected to this process.

(c) If the radiator core requires painting, spray with special radiator paint. Do not use paint mixed with oil, as this type will form an insulation on the core and prevent dissipation of heat.

(3) Inspect mounting studs, and if they are bent or damaged, replace with new studs in the following manner:

(a) Cut off old studs close to saddle.

(b) Drill remainder of studs out of saddle.

(c) Insert new studs, and weld them to top of saddle.

(4) Check mounting springs, and if they have taken a permanent set or are damaged, replace them.

(5) Inspect mounting pads and replace with new ones, if necessary.

(6) SERVICE DATA.

Stay rod studs (each side of radiator)
Size ½-20 S.A.E. Threads (1 in. x 1¼ in.)
Bottom mounting studs
Size ½-20 S.A.E. Threads (1 in. x 2⅞ in.)

(7) CONSTRUCTION OF RADIATOR OVERFLOW PIPE.

(a) Early production half-track vehicles are equipped with radiators in which the overflow tube begins just below the top of the radiator filler neck cap and passes downward through the bottom of the filler neck and along the left side of the radiator. On these vehicles the top opening of the overflow pipe will be restricted in accordance with the following instructions in order to prevent excessive loss of coolant.

(1) Remove radiator cap and insert a strip of shim stock $\frac{1}{16}$ x $\frac{3}{16}$ x 3 inches long into top opening of overflow pipe.

(2) Pinch sides of tube against shim stock.

(3) Pull shim stock out of overflow tube, and replace radiator filler cap.

(b) Be sure that the overflow tube is not entirely closed off. As the

radiator gets hot, a completely blocked tube causes pressure to build up, and the radiator may burst. When inspecting the coolant level, check to see that the overflow tube is open.

e. Reassembly.

Copper, soldering
Pot, heating, or furnace
Rod
Screwdriver
Wrench, open-end, $\frac{5}{16}$-in.

(1) REPLACE INLET AND OUTLET FITTINGS AND FILLER NECK.

Copper, soldering
Pot, heating, or furnace
Rod

Clean fittings thoroughly with acid, hold them in place and solder, using correct type of soldering rod.

(2) TEST RADIATOR ASSEMBLY FOR LEAKS.

See paragraph f, below.

(3) REPLACE SHROUD.

Screwdriver.
Wrench, open-end, $\frac{5}{16}$-in.

Set shroud in position, and replace holding screws, lock washers, and nuts.

f. Test. After the radiator has been repaired or a soldered fitting replaced, the unit should be tested for leaks in the following manner:

(1) Plug the inlet and outlet fittings and the filler neck.

(2) By slipping the rubber hose from the air line over the overflow pipe, apply air, at a pressure of 6 to 7 pounds per square inch, to the radiator.

(3) Immerse the radiator in a tank full of water, and if there are no leaks, no air bubbles will appear at the surface of the water. If bubbles do appear, the leaky places should be marked and repaired by soldering.

g. Installation of Assembly.

Hoist
Pail or water hose
Pliers
Screwdriver
Screwdriver, heavy duty
Wrench, box, $\frac{9}{16}$-in.
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, ¾-in.
Wrench, socket, $\frac{13}{16}$-in.

(1) REPLACE RADIATOR.

Hoist

Set radiator in place so that mounting studs pass through holes in frame member.

(2) CONNECT STAY RODS.

Wrench, socket, $\frac{3}{16}$-in.

Slip stay rods onto studs at each side of radiator, and replace holding lock washers and nuts.

(3) CONNECT BOTTOM OF RADIATOR TO FRAME.

Pliers
Wrench, socket, ¾-in.

Place mounting pads, springs, and washers on studs, and fasten with nuts and cotter pins.

(4) REPLACE UPPER AND LOWER RADIATOR HOSE CONNECTION.

Screwdriver.

Slide hoses onto fittings, and tighten hose clamp bolts.

(5) REPLACE LOUVER ASSEMBLY.

Hoist
Wrench, box, $\frac{9}{16}$-in.
Screwdriver, heavy duty
Wrench, open-end, ½-in.

Drop assembly into position. Fasten louver side plates to body side plates by replacing holding screws and nuts. Reconnect louver control at lower right side of radiator.

(6) REPLACE HOOD.

Screwdriver, heavy duty
Wrench, open-end, $\frac{9}{16}$-in.

Set hood in place on shutter frame and cowl. Fasten by replacing oval-head screws and nuts.

(7) REFILL RADIATOR.

Pliers
Pail or water hose

Shut off drain cock, and fill radiator to bottom of filler neck.

33. WATER PUMP AND OIL COOLER.

For complete maintenance information on these units. see TM 9-1711.

Section VIII

ELECTRICAL LIGHTING SYSTEM, BATTERIES AND ACCESSORIES

Paragraph

Introduction 34
Battery 35
Heater 36
Horn 37
Head lamps 38
Marker lamps 39
Tail lamps 40

34. INTRODUCTION.

The electrical units treated herein include the battery, heater, horn, head lamp, marker lamp and tail lamps.

a. The entire vehicle wiring diagram (fig. 105), details of the wiring harness (figs. 106, 107, 108, and 110), and the lighting system wiring diagram (fig. 109) are included in this manual to facilitate the tracing and repair of electrical cables and leads. The numbering system indicated on the vehicle wiring diagram is continued on the other wiring illustrations for ease of identification of the various cables. The color, gage, name, and terminal numbers of the cables are indicated on the details of the wiring harness.

b. All electrical equipment installed in the half-track vehicles that are related to the power plant, for instance, distributor, generator, regulator, starter motor, etc., are covered in TM 9-1711.

35. BATTERY (fig. 111).

a. Description. The battery is a Willard 6-cell, 12-volt model, with each cell containing 25 plates and generating 2 volts.

(1) CONSTRUCTION. An acid-proof container of rubber composition is used, and the cells are formed by partitions dividing the interior. These cells are closed by hard rubber covers, sealed in place, with holes in them for the cell poles. Each negative group of plates, thirteen in number, two of which are end plates, are permanently connected at the top by a welded metallic strap. The twelve positive plates, arranged alternately with the negative plates, are similarly connected in one group by a strap carrying the projecting positive terminal. Between each two adjacent

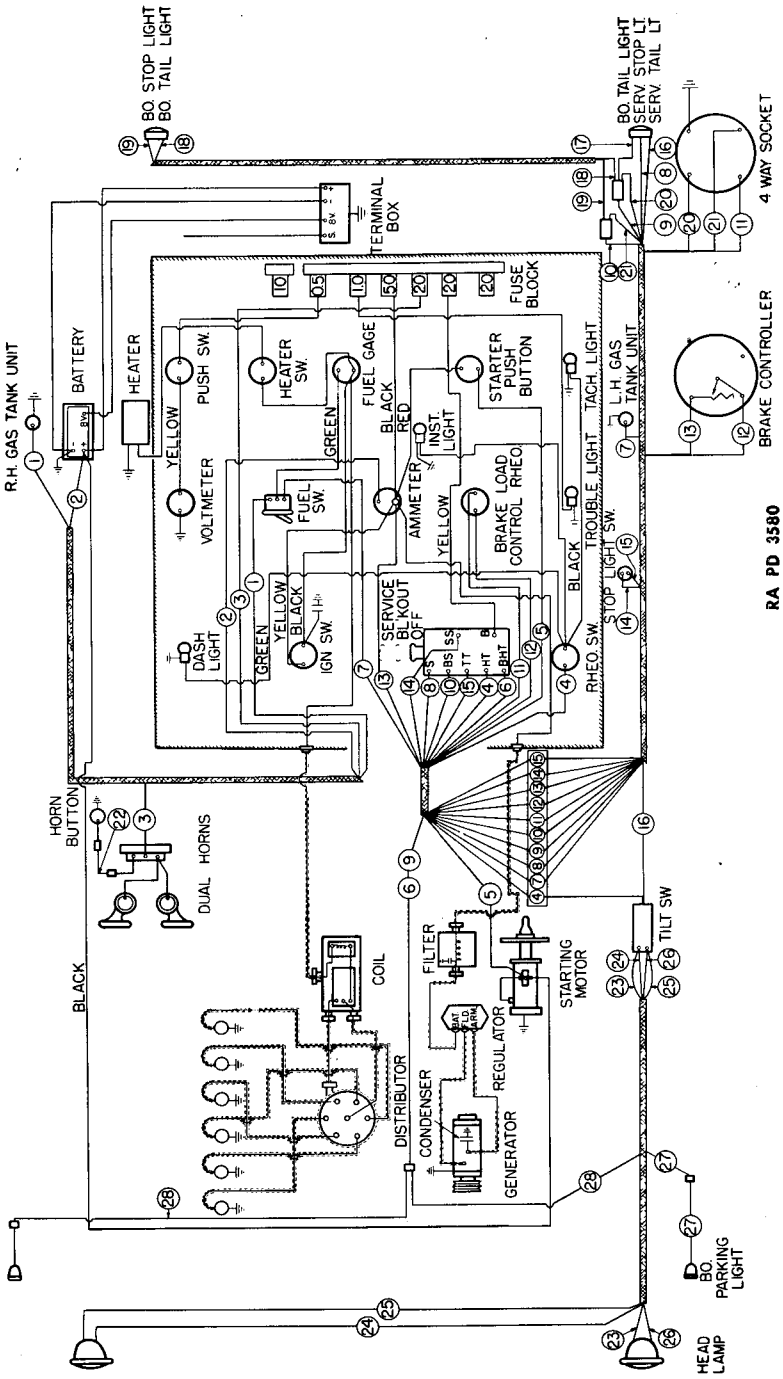
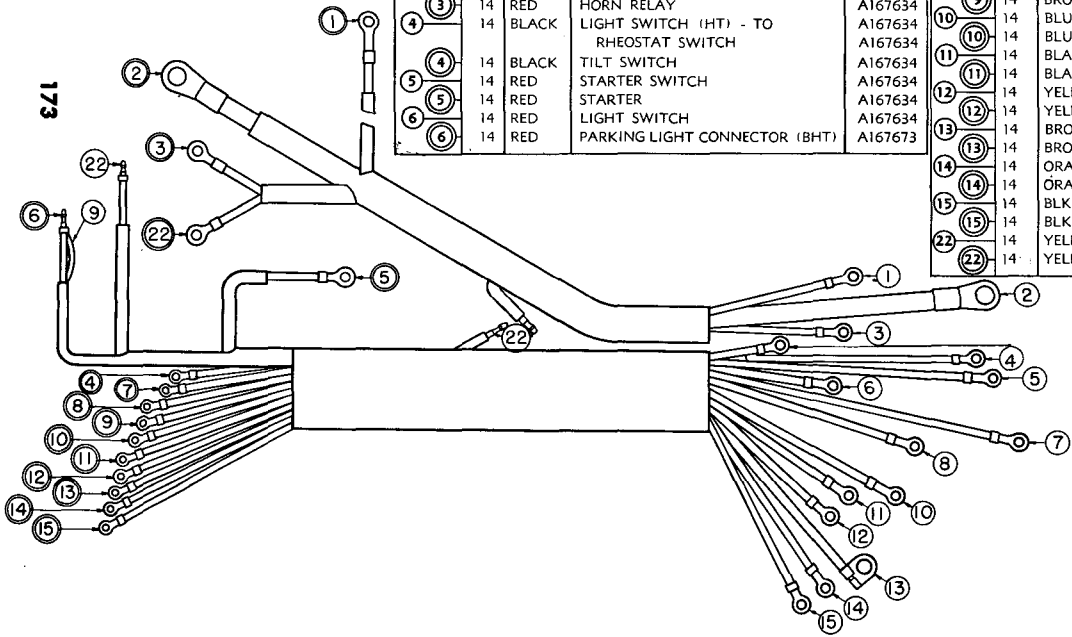


Figure 105—Vehicle Wiring Diagram

LEAD	GAGE	COLOR	CONNECTION	TERMINAL
1	#14	BLACK	FUEL GAGE SWITCH	A167634
1	14	BLACK	R.H. TANK UNIT	A167634
2	6	GREEN	AMMETER	A167652
2	6	GREEN	BATTERY (12V.) (+)	A167652
3	14	RED	20 AMP. FUSE	A167634
3	14	RED	HORN RELAY	A167634
4	14	BLACK	LIGHT SWITCH (HT) - TO RHEOSTAT SWITCH	A167634
4	14	BLACK	TILT SWITCH	A167634
5	14	RED	STARTER SWITCH	A167634
5	14	RED	STARTER	A167634
6	14	RED	LIGHT SWITCH	A167634
6	14	RED	PARKING LIGHT CONNECTOR (BHT)	A167673

LEAD	GAGE	COLOR	CONNECTION	TERMINAL
7	#14	GREEN	FUEL GAGE SWITCH	A167634
7	14	GREEN	L.H. FUEL TANK	A167634
8	14	YELLOW	LIGHT SWITCH (S)	A167634
8	14	YELLOW	SERVICE STOP LIGHT	A167634
9	14	BROWN	PARKING LIGHT CONNECTOR	A167673
9	14	BROWN	BLACKOUT TAIL LIGHT CONNECTOR	A167634
10	14	BLUE	LIGHT SWITCH (BS)	A167634
10	14	BLUE	BLACKOUT STOP LIGHT CONNECTOR	A167634
11	14	BLACK	BREAK LOAD CONTROL	A167634
11	14	BLACK	4 WAY SOCKET	A167634
12	14	YELLOW	BREAK LOAD CONTROL	A167634
12	14	YELLOW	BREAK CONTROLLER	A167634
13	14	BROWN	AMMETER	A167634
13	14	BROWN	BREAK CONTROLLER	A167634
14	14	ORANGE	LIGHT SWITCH (SS)	A167634
14	14	ORANGE	STOP LIGHT SWITCH	A167634
15	14	BLK-RED	LIGHT SWITCH (TT)	A167634
15	14	BLK-RED	STOP LIGHT SWITCH	A167634
22	14	YELLOW	HORN BUTTON CONNECTOR	A167673
22	14	YELLOW	HORN RELAY	A167634



RA PD 3778

Figure 106—Wiring Harness Assemblies (Dash, D48195; Horn and R. H. Gas Tank, D48196)

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

LEAD	GAGE	COLOR	CONNECTION	TERMINAL
4	#14	BLACK	LIGHT SWITCH (H.T.)	A167634
7	14	BLACK	TILT SWITCH	A167634
8	14	GREEN	FUEL GAGE SWITCH	A167634
9	14	GREEN	L.H. FUEL UNIT	A167634
10	14	YELLOW	LIGHT SWITCH	A167634
11	14	YELLOW	SERVICE STOP LIGHT	
12	14	BROWN	PARKING LIGHT CONNECTOR	A167634
13	14	BROWN	BLACKOUT TAIL LIGHT CONNECTOR	A167673
14	14	BLUE	LIGHT SWITCH (B.S.)	A167634
15	14	BLUE	BLACKOUT STOP LIGHT CONNECTOR	A167673
16	14	BLACK	BRAKE LOAD CONTROL	A167634
17	14	BLACK	4 WAY SOCKET	A167634
18	14	YELLOW	BRAKE LOAD CONTROL	A167634
19	14	YELLOW	BRAKE CONTROLLER	A186755
20	14	BROWN	AMMETER	A167634
21	14	BROWN	BRAKE CONTROLLER	A186755
22	14	ORANGE	LIGHT SWITCH	A167634

LEAD	GAGE	COLOR	CONNECTION	TERMINAL
14	#14	ORANGE	STOP LIGHT SWITCH	A214951
15	14	BLK-RED	LIGHT SWITCH (TT)	A167634
16	14	BLK-RED	STOP LIGHT SWITCH	A214951
16	14	YELLOW	TILT SWITCH	A167634
17	14	YELLOW	SERVICE TAIL LIGHT	
17	14	BROWN	BLACKOUT TAIL LIGHT CONNECTOR	A167673
18	14	BROWN	L.H. BLACKOUT TAIL LIGHT	
18	14	BLUE	BLACKOUT TAIL LIGHT CONNECTOR	A167673
19	14	BLUE	R.H. BLACKOUT TAIL LIGHT	
19	14	GREEN	BLACKOUT STOP LIGHT CONNECTOR	A167673
20	14	GREEN	BLACKOUT STOP LIGHT	
20	14	RED	BLACKOUT TAIL LIGHT CONNECTOR	A167673
21	14	RED	4 WAY SOCKET	A167634
21	14	WHITE	BLACKOUT STOP LIGHT CONNECTOR	A167673
21	14	WHITE	4 WAY SOCKET	A167634

RA PD 3779

Figure 107—Wiring Harness Assembly (Rear Chassis, D48197)

LEAD	GAGE	COLOR	CONNECTOR	TERMINAL
23	#14	BLACK	TILT SWITCH	A167634
23	14	BLACK	L.H. HEAD LAMP	
24	14	BLACK	TILT SWITCH	A167634
24	14	BLACK	R.H. HEAD LAMP	
25	14	GREEN	TILT SWITCH	A167634
25	14	GREEN	R.H. HEAD LAMP	
26	14	GREEN	TILT SWITCH	A167634
26	14	GREEN	L.H. HEAD LAMP	
27	14	BROWN	PARKING LAMP CONNECTOR	A167673
27	14	BROWN	L.H. PARKING LAMP	A167673
28	14	BROWN	PARKING LAMP CONNECTOR	A167673
28	14	BROWN	R.H. PARKING LAMP	A167673

RA PD 3780

Figure 108—Wiring Harness Assembly (Front Chassis, D48198)

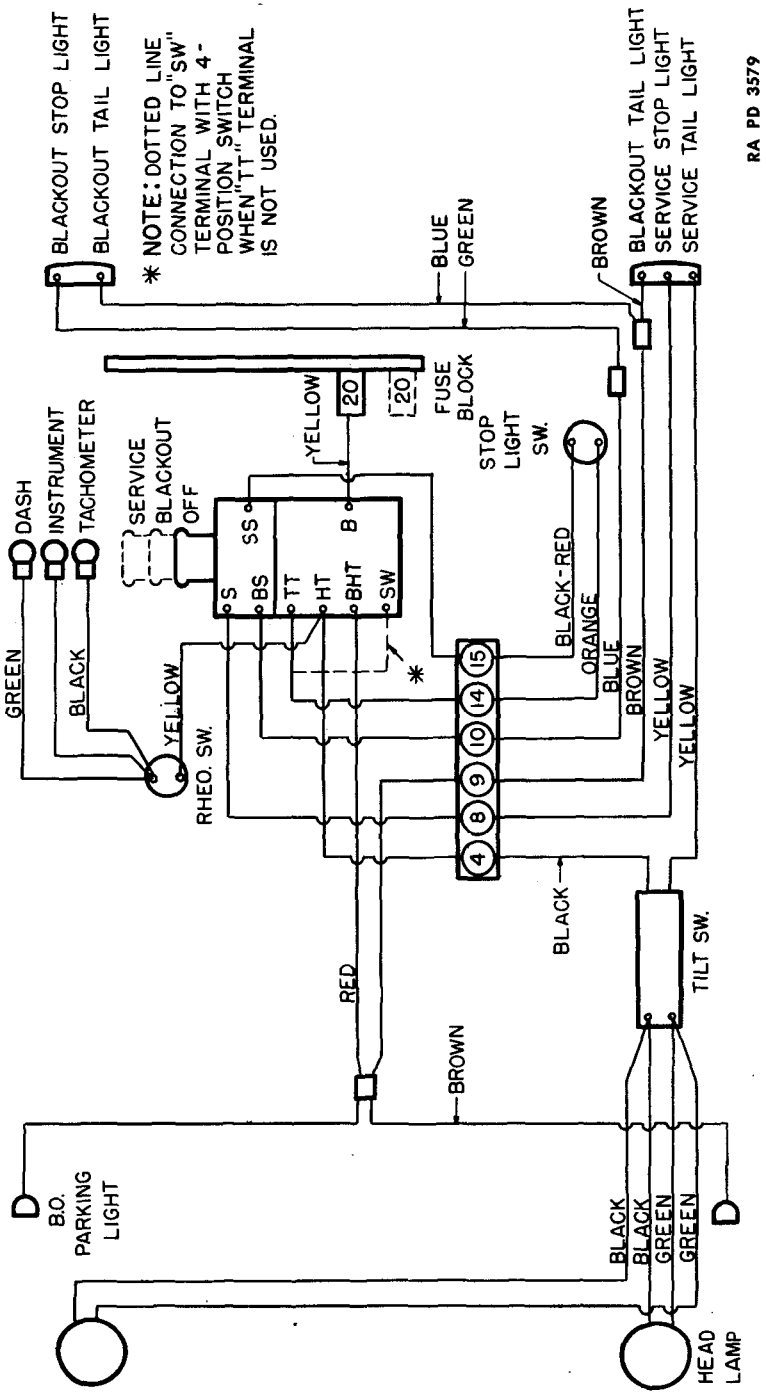
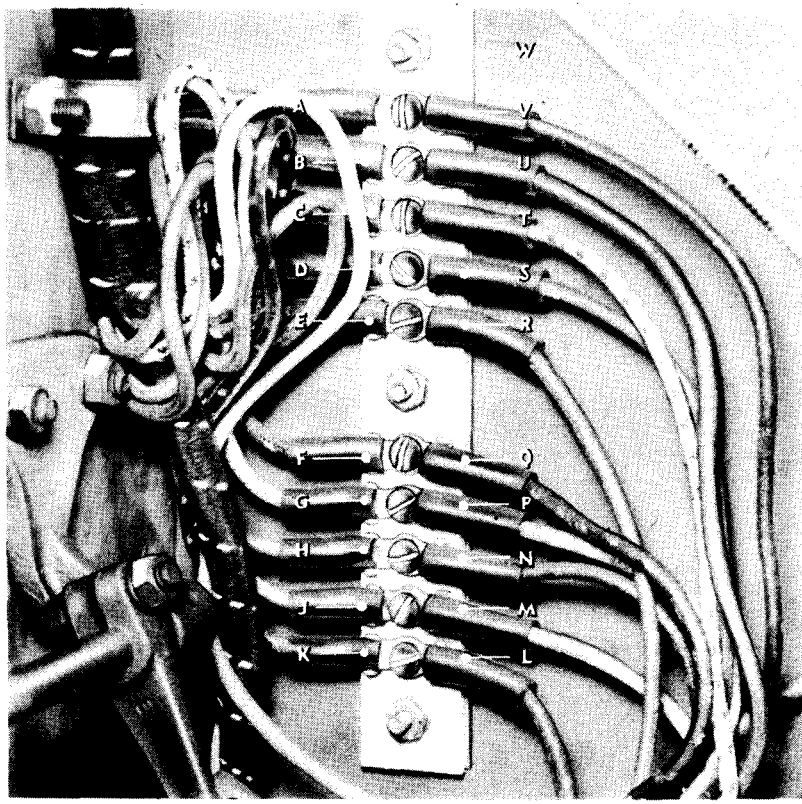


Figure 109—Lighting System Wiring Diagram

ELECTRICAL LIGHTING SYSTEM, BATTERIES AND ACCESSORIES

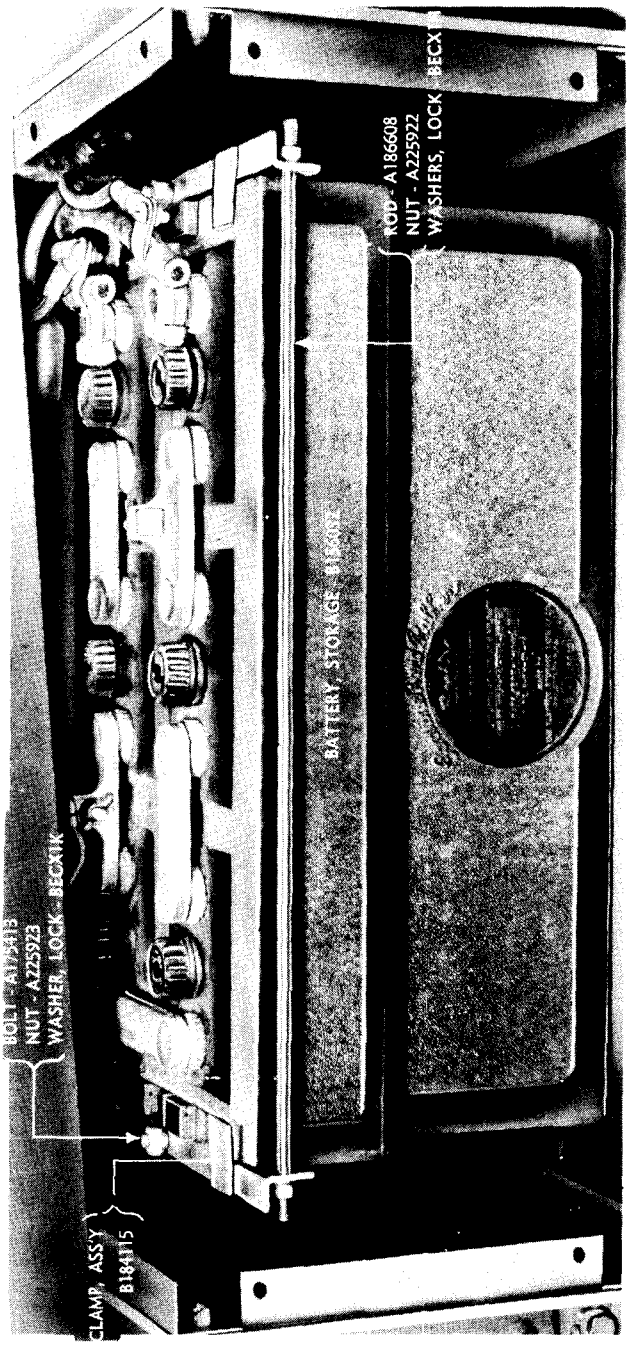


A — LEAD TO LIGHT SWITCH TERMINAL "HT" (BLACK)
B — LEAD TO FUEL GAGE SWITCH (GREEN)
C — LEAD TO LIGHT SWITCH TERMINAL "S" (YELLOW BLACK TRACER)
D — LEAD TO BLACKOUT PARKING LIGHT CIRCUIT CONNECTOR (BROWN)
E — LEAD TO LIGHT SWITCH TERMINAL "BS" (BLUE)
F — LEAD TO BRAKE LOAD CONTROL RHEOSTAT (BLACK NAT. TRACER)
G — LEAD TO BRAKE LOAD CONTROL RHEOSTAT (YELLOW RED TRACER)
H — LEAD TO AMMETER COMMON TERMINAL (BROWN RED TRACER)
J — LEAD TO LIGHT SWITCH TERMINAL "SW" (ORANGE)
K — LEAD TO LIGHT SWITCH TERMINAL "SS" (BLACK RED TRACER)
L — LEAD TO STOP LIGHT SWITCH (BLACK RED TRACER)
M — LEAD TO STOP LIGHT SWITCH (ORANGE)
N — LEAD TO BRAKE CONTROLLER TERMINAL "BATTERY" (BROWN RED TRACER)
P — LEAD TO BRAKE CONTROLLER TERMINAL "BRAKE" (YELLOW RED TRACER)
Q — LEAD TO CONNECTOR SOCKET FOR TRAILER - TERMINAL "BRAKE 6 V." (BLACK NAT. TRACER)
R — LEAD TO CONNECTOR FOR BLACKOUT STOP LIGHTS (BLUE)
S — LEAD TO CONNECTOR FOR SERVICE TAIL LIGHT (BROWN)
T — LEAD TO SERVICE TAIL LIGHT (YELLOW BLACK TRACER)
U — LEAD TO FELT FUEL TANK UNIT (GREEN)
V — LEAD TO TILT SWITCH (BLACK)
W — BLOCK ASSEMBLY - B184298
SCREW - A225930
NUT - A225928
WASHER, LOCK - A215845

RA PD 3578A

Figure 110—Terminal Block—Installed

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES



RA PD 3559A

Figure 111—Battery—Installed

positive and negative plates is an insulator or separator of specially treated wood or rubber, in sheets, with vertical ribs on its face. The plates and separators are vertically installed on ribs molded in the bottom of the container with a sediment space provided on the bottom. The exposed terminals of each cell are joined, positive to negative, by outside connectors welded to the terminals on the top battery, thereby connecting the cells in series.Vents, with screw-type closure plugs which have small openings for the escape of gas, permit inspection of the inside of the cells and replenishment of the electrolyte and water. Circular rubber gaskets around the posts in the covers make the terminals leakproof.

(2) OPERATION. The battery produces electricity by chemical action of dilute sulphuric acid on the plates. The capacity of the battery depends upon the size and number of the plates. The plates are made of stiff lead-antimony alloy castings, mesh or grid-shaped, with the openings filled with a paste consisting chiefly of oxide of lead. The plates are formed by putting them through an electro-chemical process in tanks containing dilute acid, before mounting them in the cells, to convert the material on the positive plates into brown peroxide of lead and that on the negative plates into gray, spongy, metallic lead. With the plates so charged, immersing them in the dilute acid in the container will deliver current whenever the outside circuit is completed. In the discharge of the battery, the sulphuric acid is transformed into water, and both the lead peroxide and some of the metal of the plates are converted into lead sulphate. The discharge must be stopped and the battery recharged, before all the metal of the plates has combined with the acid.

(3) SPECIFICATIONS.

Make Willard	Ordnance No. B156032
Type Lead-acid . . . commercial	White No. 311936
Model WH-25-6	Autocar No. 16WA0440
Manufacturer's No. . . WB-4376	Diamond T No.

Number of cells 6

Number of plates per cell 13 negative, 12 positive

Voltage 12 volts

Terminal grounded Negative

Specific gravity fully charged 1.275-1.300

Recharge at 1.200 (hydrometer reading)

Capacity Ampere hours, 204 at 20-hr rate

Location Right side of vehicle on running board, in metal compartment.

Dimension, overall $20\frac{7}{16}$ x $10\frac{5}{16}$ x $10\frac{1}{4}$

Radio take-off points provided at positive, negative, 8-volt terminals.

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) FAILURE OF ENGINE AND STARTING MOTOR TO ROTATE WHEN STARTING SWITCH IS CLOSED.	
Loose or dirty terminals at battery.	Clean and tighten terminals.
Cells dry.	Add water to a depth of ⅜ inch above plates.
Defective starting switch.	Inspect, clean, repair or replace.
Battery discharged.	Recharge battery. Check generator to make sure it is charging by inspecting and testing both generator and regulator (TM 9-1711).
One or more cells shorted.	Remove, dismantle, and repair or replace battery.
(2) SLOW STARTER SPEED.	
Battery run down.	Recharge battery.
Loose or dirty terminals.	Clean and tighten.
Defective starter motor.	Repair or replace (TM 9-1711).
(3) INABILITY OF CELL TO HOLD CHARGE ON OPEN CIRCUIT, UNDUE HEATING, LITTLE OR NO RISE IN VOLTAGE OR SPECIFIC GRAVITY, OR FAILURE TO GAS PROPERLY ON CHARGING.	
Much sediment or defective insulation in cell causing short circuit.	Dismantle and rebuild, or replace battery.

c. Removal of Assembly.

Wrench, open-end ⅝-in.

(1) REMOVE METAL COVER AND SIDE PLATES OF BATTERY COMPARTMENT.

Wrench, open-end, ⅝-in.

Remove three bolts in battery top housing armor plate, and four bolts with lock washers from battery side housing armor plate. Remove plates.

(2) DETACH CABLES.

Wrench, open-end, ⅝-in.

Loosen one nut on each terminal, removing negative lead first.

(3) RELEASE BATTERY CLAMP.

Wrench, open-end, ⅝-in.

Remove two nuts and lock washers attaching battery. Hold down hook bolt to battery tray clamp.

(4) REMOVE CLAMP FRAME FROM AROUND TOP OF BATTERY.
Wrench, open-end, 5/8-in.
Loosen two nuts on battery clamp rods, remove battery clamp.

(5) REMOVE BATTERY. Lift out of compartment.

d. Maintenance.

(1) At least once a week inspection should be made of hold-down frame and hook bolts, terminals, and electrolyte.

(2) Keep the level of the electrolyte at least 3/8 inch above the plates. Look for a leak in the container if the electrolyte appears too low in any cell. Add pure (preferably distilled) water. Do not use city, spring, or well water unless analyzed and approved. Boiling, filtering and the use of softening materials or devices will not remove impurities which may injure the battery. Wipe off top of battery and terminals afterward. It is best to replenish just before a run when the battery will be working. Unmixed water will freeze in cold weather. Remove vent plugs and test each cell with an accurate hydrometer, inserting rubber tube into the electrolyte. The reading for a fully charged cell should be between 1.275 and 1.300. If any two cells are below 1.200 on two successive testing days have the entire battery tested and fully charged.

(3) A partially discharged battery may freeze in winter. Therefore, in cold weather, the battery should be kept fully charged, particularly if the vehicle stands in a cold place for any length of time. The freezing point of the electrolyte depends on its specific gravity. When fully charged, the specific gravity is highest, and at 1.300 the electrolyte will remain liquid at a temperature far below zero.

	Specific gravity	Freezing temperature
Battery charged	1.285	−96 F (−70 C)
Battery 1/3 charged	1.255	−60 F (−50 C)
Battery 1/2 discharged	1.220	−31 F (−30 C)
Battery 3/4 discharged	1.185	− 8 F (−22 C)
Battery normally discharged	1.150	+ 5 F (−15 C)
Battery completely discharged	1.100	+18 F (− 8 C)

(4) A fully charged battery, if it stands idle long enough, will discharge slowly to a point where freezing may ensue. If the vehicle is stored for a long time without heat in very cold weather, the battery should be lifted out and taken to a place where it can be serviced. In warm surroundings an idle battery will discharge much faster. After being idle for a time and then being put back into service, the plates may buckle and so have a shorter life and a much reduced capacity to recharge. A battery standing idle should be fully recharged every thirty days.

(5) Heating of the battery in service above 100 F must not be permitted. Watch the battery in warm weather, and feel the top connectors. If these are warmer to the touch than the normal temperature of the human body, check the electrolyte with a thermometer. If the temperature reaches 130 F, the battery may be ruined, chiefly by buckling of plates, disintegration of the active material and short-circuiting because of damage to the insulators. Whenever the battery is found to be getting too warm on a run, turn on some of the lights, or cut down the charging rate. If heating continues, the whole electrical system ought to be checked as soon as possible.

(6) The battery cannot stand discharged even if not needed for use. When discharged, the acid attacks the plates and gives them a white sulphate coating which is a poor conductor of electricity. This reduces the capacity of the battery for charging and discharging and lessens the effective area of the plates. Sulphation will also appear at the top of the plates if the electrolyte is not kept at the correct level. Whenever any evidence of sulphation is seen, the battery should be removed and recharged. It may be restored to working efficiency by a low charging rate over a period of several days.

(7) Acid should never be added to the battery except when some of it has leaked out or spilled, or the electrolyte has been diluted with too much water. Adding acid to raise the specific gravity will not increase the charge. It will render hydrometer readings of no value and shorten the life of the battery. When acid has been lost, add acid not above 1.400 specific gravity, charge battery or empty battery, and then put in a new supply at 1.280 specific gravity. If the battery acid is ever found to be too strong or high, remove some of the electrolyte and put in more water. If the battery is being charged and the acid shows too much strength, continue charging, and correct in the same way.

(8) Check battery terminals and keep them tight. Clean them with ammonia or a solution of baking soda in water. Wash afterwards with warm water. Coat terminals with petrolatum before tightening. Do not use cup grease. Inspect ground strap and motor cable, and replace these if worn or corroded.

(9) If a new battery is received dry, it should, after being filled with electrolyte and before being put into service, be given an equalizing charge at half the regular charging rate until it gasses freely, to assure correct specific gravity and voltage.

e. Installation of Assembly.

Wrench, open-end, 5/8-in.

(1) REPLACE IN COMPARTMENT.

Lift battery into compartment with poles in position to receive cable terminals.

(2) REPLACE CLAMP.

Wrench, open-end, 5/8-in.

Put clamp on top of battery; tighten nuts on horizontal clamp rods.

(3) FASTEN BATTERY IN PLACE.

Wrench, open-end, 5/8-in.

Engage two hook bolts with cleats at bottom of compartment. Push upper ends through two clamps. Attach one lock washer and one nut to each hook bolt and tighten.

(4) ATTACH CABLES TO POLES.

Wrench, open-end, 5/8-in.

Tighten one nut on each terminal.

(5) PUT ON TOP AND SIDE OF COMPARTMENT.

Wrench, open-end, 5/8-in.

Attach top plate with three screws and lock washers and side plate with four screws and lock washers.

36. HEATER.

a. Description. The heater is a Bishop and Babcock hot-water unit installed on the inside of the dash under the instrument panel. The core is connected to receive water from the engine, and the motor is controlled by a rheostat switch and operated by current from the battery. Fan, motor and core are covered by a suitable case which is open for admission of air to be warmed in the heater and diffused therefrom.

(1) CONSTRUCTION. The case consists of a back and scroll assembly at the rear, and a front with slots having inclined baffle plates or louvers along their edges to deflect and distribute the warm air. The core is located in the front of the case, and in the back are the fan and motor. From the top and bottom of the core, through holes in the dash, project tubes, the lower of which is connected by a hose to a nipple in the top of the engine, and the other by a hose to a nipple in the oil cooler of the engine. The engine head nipple contains a valve which can be turned to stop the flow of water from the engine to the heater.

(2) OPERATION. When the engine is running, the water in the cooling jacket is heated, and when the cock in the nipple on top of the engine is opened, some of the water is diverted through the core of the heater.

To warm the vehicle, the rheostat switch on the instrument panel is turned to connect the motor to the battery and set the fan into motion. Warm air is then circulated by the fan.

(3) SPECIFICATIONS.

Make Bishop & Babcock	Ordnance No. C85528
Type Hot water	White No. 376172
Model Electric Motor-Fan	Autocar No. 16W41635
Manufacturer's No. BI-X24109	Diamond T No.

Fan	6 blades
Controller switch	Rheostat
Motor speeds	3
Operating voltage	12—13 volts
Operating current	4 amperes

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) FAILURE OF MOTOR TO RUN WHEN SWITCH IS CLOSED.	
Broken lead or ground.	Check connections and switch.
Trouble in motor.	Check and adjust or repair motor.
(2) FAILURE TO HEAT WITH FAN RUNNING.	
Valve closed.	Open valve.
Obstructed hose or core.	Clean hose and flush core.
Water leaks.	Tighten hose clamps. Replace hose when worn or rotted.

c. Removal of Assembly.

Screwdriver
Wrench, open-end, 3/8-in.

(1) DETACH HOSE CONNECTIONS.

Screwdriver

Turn off cock at top of engine. Loosen two hose clamps at heater tubes and disconnect hose sections.

(2) DISCONNECT MOTOR LEAD.

Remove cable from connector.

(3) DISMOUNT HEATER FROM DASH.

Wrench, open-end, 3/8-in.

Remove three nuts, three lock washers, three plain washers, three bolts, and three spacers, mounting heater to dash and remove heater.

d. Disassembly.

Screwdriver — Wrench, open-end, 3/8-in.

(1) DETACH HEATER FRONT.

Screwdriver

Remove four screws and remove heater front.

(2) WITHDRAW CORE AND HURRICANE.

Remove core and hurricane from heater by hand.

(3) DISMOUNT FAN AND MOTOR.

Wrench, open-end, 3/8-in.

Remove two plain washers, two lock washers, and two nuts, and remove fan and motor assembly.

(4) DETACH FAN FROM MOTOR.

Screwdriver

Remove set screw from hub of fan, and remove fan from motor assembly.

e. Maintenance and Adjustments.

(1) When engine and radiator are flushed, disconnect heater hose from engine and wash core. Flush with air pressure if core seems clogged. Watch core and hose for possible leaks. Keep hose clamps at core and engine and nuts on mounting stud tight.

(2) Make sure fan is secured firmly to motor shaft and motor secured to back plate.

(3) Take motor out of housing, and lubricate bearings regularly.

(4) The commutator and brushes should be kept clean and the motor otherwise inspected, tested, and repaired in the same way as the starting motor.

f. Reassembly of Components.

Screwdriver — Wrench, open-end, 3/8-in.

(1) ATTACH FAN.

Screwdriver

Put hub on front end of motor shaft and fasten set screw.

(2) MOUNT MOTOR AND FAN.

Wrench, open-end, 3/8-in.

Insert motor in housing, pass ends of bolts through rear, and put on two plain washers, two lock washers, and two attaching nuts.

(3) REPLACE CORE AND HURRICANE.

Mount hurricane at front of back assembly; place core over it, passing tubes through back plate.

(4) REPLACE HEATER FRONT.

Screwdriver

Attach heater to front over core, and insert and tighten four screws.

g. Installation of Assembly.

Screwdriver

Wrench, open-end, 3/8-in.

(1) MOUNT HEATER ON INSIDE OF DASH.

Wrench, open-end, 3/8-in.

Pass tubes of core outward through holes in dash. Put three attaching bolts through back plate, slip on spacers, and pass bolts through holes in dash. Attach plain and lock washers and nuts at front of dash, and tighten nuts.

(2) CONNECT MOTOR LEAD.

Connect cable to connector.

(3) CONNECT HEATER TO ENGINE.

Screwdriver.

Slip hose ends on tubes in front of dash, and replace hose clamps.

37. HORN.

a. Description. The horn is a duel Delco-Remy vibrator-type unit. It consists of two electromagnetic units (one high, one low note) mounted close together on separate brackets on the engine side of the dash below the air cleaner. The brackets, mounting screws, and component parts of the two units are interchangeable except for the diaphragm and collar assemblies.

(1) CONSTRUCTION (fig. 112).

(a) Each unit has a round base, shaped like a shallow inverted pan, with an out-turned rim to engage the edge of the diaphragm. The base and diaphragm are attached by screws to the top of the collar assembly to hold the diaphragm over the sound channels. The middle of the base has an opening in which are placed a pole-piece, an electromagnetic coil and a flat plate armature. The base and armature are parallel. The pole is E-shaped with three polar projections and three polar faces, with the magnetic coil surrounding the middle one, and is placed so that all three projections are presented to the armature. The middle projection has a bore for a stud to connect the armature and diaphragm together. The pole-piece has angle-shaped side plates, and is secured to the base

by studs passing through holes in the side plates and nuts on the studs to hold the plates fast.

(b) Mounted on a bracket secured to the base is a fixed grounded contact support and point, and engaging it is a movable point on a flat insulated spring, which is also fixed to the bracket and is actuated by the armature, when attracted by the coil, to separate the electric contact points. The base also mounts a resistance in series with the coil, but the fixed and movable contact points form a shunt circuit to ground between the coil and the resistance. A shell or cover, fastened to a bracket spanning the top of the collar assembly, houses the electromagnetic coil and armature.

(c) The horns are controlled by an electromagnetic relay mounted on the front of the dash close to the horns. The relay consists of a coil having one terminal connected to the battery and the other to the horn button at the upper end of the steering column. Branch wires, in parallel, lead from a fixed terminal and a movable terminal controlled by the relay coil, to the two electromagnetic coils of the horn units.

(2) OPERATION. Pressure on the horn button closes the relay circuit, bringing the terminals of the relay together and closing the circuit to both horns. Current passes through the magnetic coils, through the contact points adjacent the armatures, and then to ground. The horn electromagnetics are energized and attract the armatures, which break the direct shunt connections to ground, and include the resistances in the horn electrical circuit. As a result, the current falls off and the electromagnets are momentarily weakened. This make and break circuit causes the armatures to vibrate rapidly, imparting motion to the diaphragm, and producing sound in both horns. Better performance is obtained because the voltage drop between battery and horns is small and the current therefore always sufficient.

(3) SPECIFICATIONS.

Make Delco-Remy

Type Electric Vibrator

Model Dual

Manufacturer's No.

Horn kit (includes high and low pitch horns and mounting bracket)	DR-1880566
High pitch horn	DR-1999526
Low pitch horn	DR-1999525

Ordnance No.

Horn kit	A214451
High pitch horn	C74054
Low pitch horn	C74053

White No.

Horn kit	353752
High pitch horn	353754
Low pitch horn	353753

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

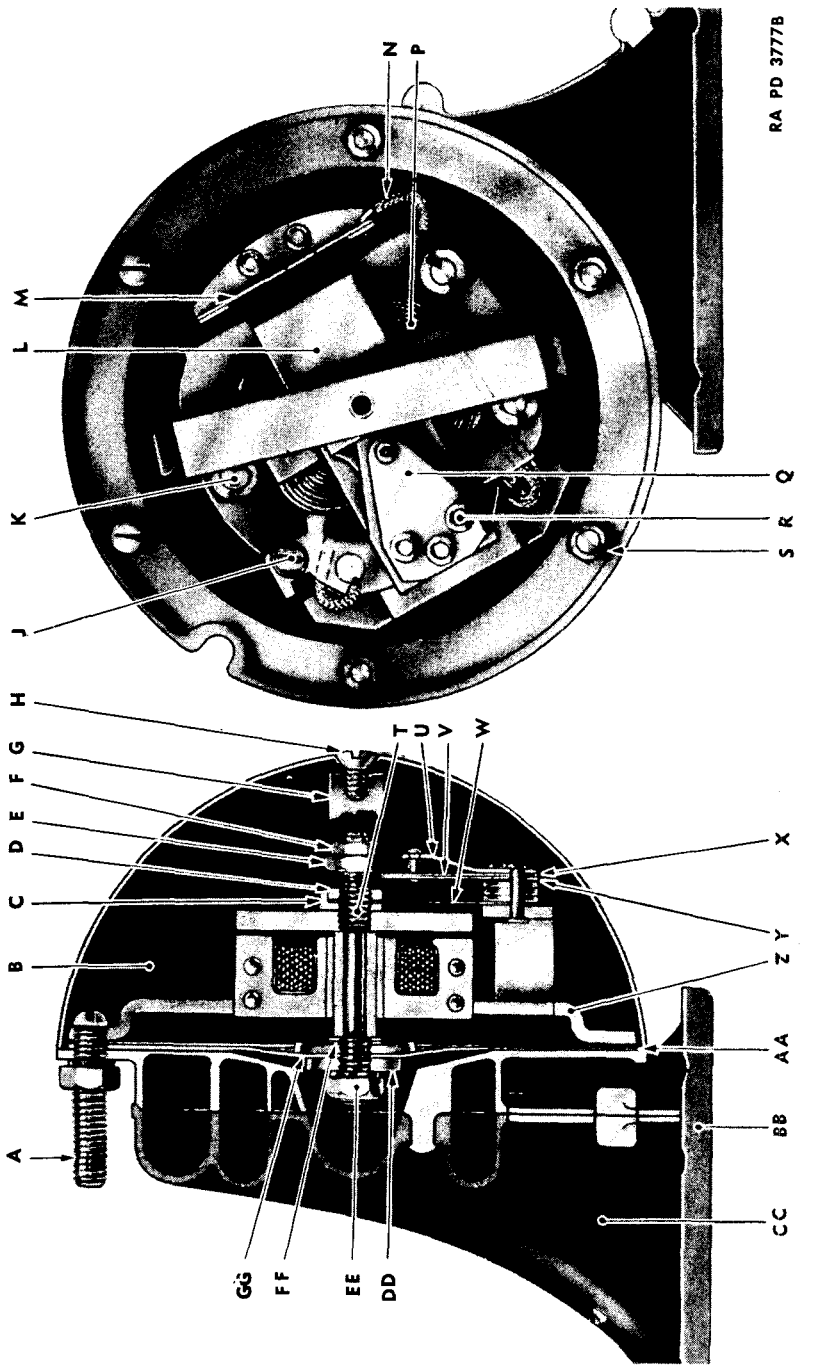


Figure 112A—Horn Assembly—Sectionalized

A — SCREW - DR-1865938
NUT - A214449
WASHER, LOCK - DR-103319

B — SHELL - DR-1853944

C — PLATE - DR-1874156

D — NUT - DR-1842874

E — NUT - DR-184270

F — NUT, LOCK - DR-120614

G — BRACKET - DR-1850660

H — SCREW - DR-1853975

J — SCREW - DR-1864099
WASHER, LOCK - DR-802729

K — NUT - DR-821204

L — ARMATURE - DR-1864082

M — **RESISTOR**

N — LEAD, ASS'Y - DR-1885891

P — SCREW - DR-1853970
NUT - DR-1843521
WASHER, LOCK - DR-118874

Q — COIL, ASS'Y - DR-1874660

R — INSULATION - DR-1858675

S — RIVET - DR-1857430

T — SPRING - DR-1853932

U — BLADE, ASS'Y - DR-1861972

V — SUPPORT & POINT, ASS'Y - DR-1861054

W — CONNECTOR - DR-1858676

X — INSULATION - DR-1858678

Y — STUD - DR-18722634

Z — BASE, ASS'Y - DR-1880532

AA — DIAPHRAM — LOW NOTE - DR-1878815
HIGH NOTE - DR-1878816

BB — BAND - DR-1880464

CC — WASHER - DR-1865880

DD — WASHER, LOCK - DR-103319

EE — NUT - A214419

FF — WASHER - DR-1855396

GG — WASHER - DR-1856598

HH — COOLER, ASS'Y - LOW NOTE - DR-1878615
HIGH NOTE - DR-1878618

RA PD 3777B

Figure 112B—Horn Assembly—Nomenclature

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Autocar No.		Diamond T No.	
Horn kit	16W22740	Horn kit	N1591
High pitch horn	16WA4640	High pitch horn	N2591
Low pitch horn	16W4640	Low pitch horn	N3591

Components 1 high note horn
1 low note horn

Parts Interchangeable for both horns, except diaphragms and spiral air column collar assemblies.

Control Through outside relay coil and horn button switch.

Horn operating voltage 12 volts

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) FAILURE OF HORNS TO OPERATE.	
Horn button switch out of order.	Repair or replace (see section XIII.
Horn relay out of order.	Repair or replace.
Horns out of order.	Check armatures, spring, studs, and terminals. Make sure studs are properly fixed to diaphragms. Adjust nuts on base studs to raise or lower pole-pieces to correct armature air gaps. Adjust nuts on top of studs for correct operation of movable terminals.
Loose or open connections.	Check cables and terminal screws at horn button, fuse block, horn relay, and horns. Replace 20-ampere fuse if necessary.
Battery weak.	Charge or replace.
Ground between horns and relay, or at relay coil.	Check and repair cables and insulation.
Grounded coil or terminals in horns.	Check and clean terminals; remove and test coils.

(2) HORNS IRREGULAR OR WEAK.

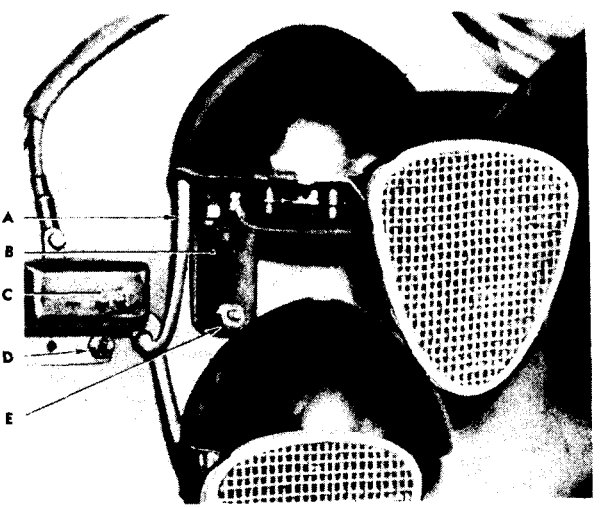
Battery weak.	Charge or replace.
Armature air gap incorrect.	Raise or lower pole and coils to correct gap.
Worn or dirty terminals.	Clean terminals of horn relay and horn button switch, and terminals inside horns.
Loose connections, grounded cable, or partially open circuit.	Check wires and insulation, and tighten terminal screws.
Nuts on armature studs at diaphragms loose or out of correct position.	Adjust nuts and tighten.
Obstruction in sound channels.	Check screen at mouth of trumpets or "collar" assemblies. Clean inside sound channels, removing screens if necessary.

c. Removal of Assembly (fig. 113).

Screwdriver, medium-sized.
Wrench, open-end, $\frac{7}{16}$-in.

(1) REMOVE HORN UNITS.

Wrench, open-end, $\frac{7}{16}$-in.



A — CABLE, ASS'Y - B184242
B — BRACKET - C85573
C — RELAY - A175468
D — SCREW - A225924, NUT - A225940, WASHER, LOCK - BECX1G
E — BOLT - A225979, NUT - A215224, WASHER, LOCK - BECX1G

Figure 113—Horn Assembly—Installed RA PD 53743

Remove two nuts and two lock washers holding each horn unit to bracket and remove units.

(2) DISCONNECT CABLES FROM HORNS.
Screwdriver, medium-sized.

Remove top screw from shell and remove shell from each horn. Remove terminal screw and lock washer, and remove cables.

d. Disassembly of Components (figs. 112 and 114).

Copper, soldering
Screwdriver
Wrench, open-end, $\frac{5}{16}$-in.
Wrench, open-end, $\frac{3}{8}$-in.
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{1}{2}$-in.

(1) REMOVE STRAP BRACKET FROM BASE. Disengage ends of bracket.

(2) REMOVE BASE, STUD AND BRACKET ASSEMBLY, AND DIAPHRAGM FROM COLLAR.
Screwdriver
Wrench, open-end, $\frac{5}{16}$-in.

Remove two mounting screws. Remove four nuts and four lock washers, and after lifting off base assembly, remove four screws.

(3) REMOVE DIAPHRAGM FROM ARMATURE STUD ON BASE ASSEMBLY.
Wrench, open-end, $\frac{7}{16}$-in.

Remove nut and lock washer from armature stud, and remove high note diaphragm or low note diaphragm and three washers.

(4) SEPARATE ARMATURE STUD FROM COIL.
Wrench, open-end, $\frac{5}{16}$-in.
Wrench, open-end, $\frac{1}{2}$-in.
Wrench, open-end, $\frac{3}{8}$-in.

Remove lock nut and contact support nut. Remove stud, and remove clamp plate and nut from top of armature. Remove armature assembly.

(5) REMOVE COIL ASSEMBLY FROM BASE ASSEMBLY.
Wrench, open-end, $\frac{7}{16}$-in.

Remove three nuts from studs on base and remove field coil and pole. The leads remain connected to base assembly.

(6) DETACH COIL AND POLE-PIECE FROM BASE.
Copper, soldering

Melt solder at coil terminals.

e. Maintenance and Adjustments.

(1) Armature should be securely mounted. If loose over magnetic coil, turn armature stud from lower end to tighten nut above clamp plate, and bind nut, clamp plate, spring, armature and top of stud closely together.

(2) If armature air gap is too small or too large, set nuts on studs of base to hold pole assembly with three polar faces about $\frac{1}{32}$ inch from armature (figs. 115 and 116). Keep these nuts tight so that pole-piece and coil are at all times firmly mounted on base.

(3) If armature stud has any play at diaphragm, the latter will not vibrate properly. Keep nut on lower end of armature stud tight to prevent this.

(4) When stud is tight at armature and diaphragm, the fixed and movable terminals above the armature must be in contact. If separated, adjust operating nut and lock nut until points are closed. If the points are not clean, rub them with a thin fine-cut file.

(5) If leads of coil are broken or disconnected, solder the ends to the terminals on the bracket supporting the armature terminals. Examine coil to see if insulation is intact; test for ground, if necessary, and replace pole assembly and coil if the coil is damaged.

(6) Keep base assembly screwed tightly on collar, and shell secured firmly; also horn should be attached fast to support bracket to prevent rattling of parts. Inspect frequently by lifting shells.

f. Reassembly.

Copper, soldering
Pliers
Screwdriver
Wrench, open-end, $\frac{5}{16}$-in.
Wrench, open-end, $\frac{3}{8}$-in.
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{1}{2}$-in.

(1) REPLACE POLE ASSEMBLY IN BASE ASSEMBLY.

Wrench, open-end, $\frac{7}{16}$-in.

Hold up flat armature spring. Slip pole assembly under spring sideways on base studs. Replace three nuts on base studs.

(2) ATTACH LEADS OF COIL TO TERMINALS AT BRACKET ON BASE.

Copper, soldering

Solder leads and terminals together.

(3) ASSEMBLE ARMATURE, STUD, BINDING PIECE, AND CLAMP PLATE WITH COIL AND POLE.

Wrench, open-end, $\frac{5}{16}$-in.

Lay armature on upper faces of pole-piece under spring. Put clamp plate on top between armature and spring. Lay binding piece on clamp plate. Pass armature stud from below through central hole in pole-piece, through hole in armature, and holes in spring and clamp plate into threaded hole of binding piece. Apply wrench to lower part of hexagonal surface of stud and tighten.

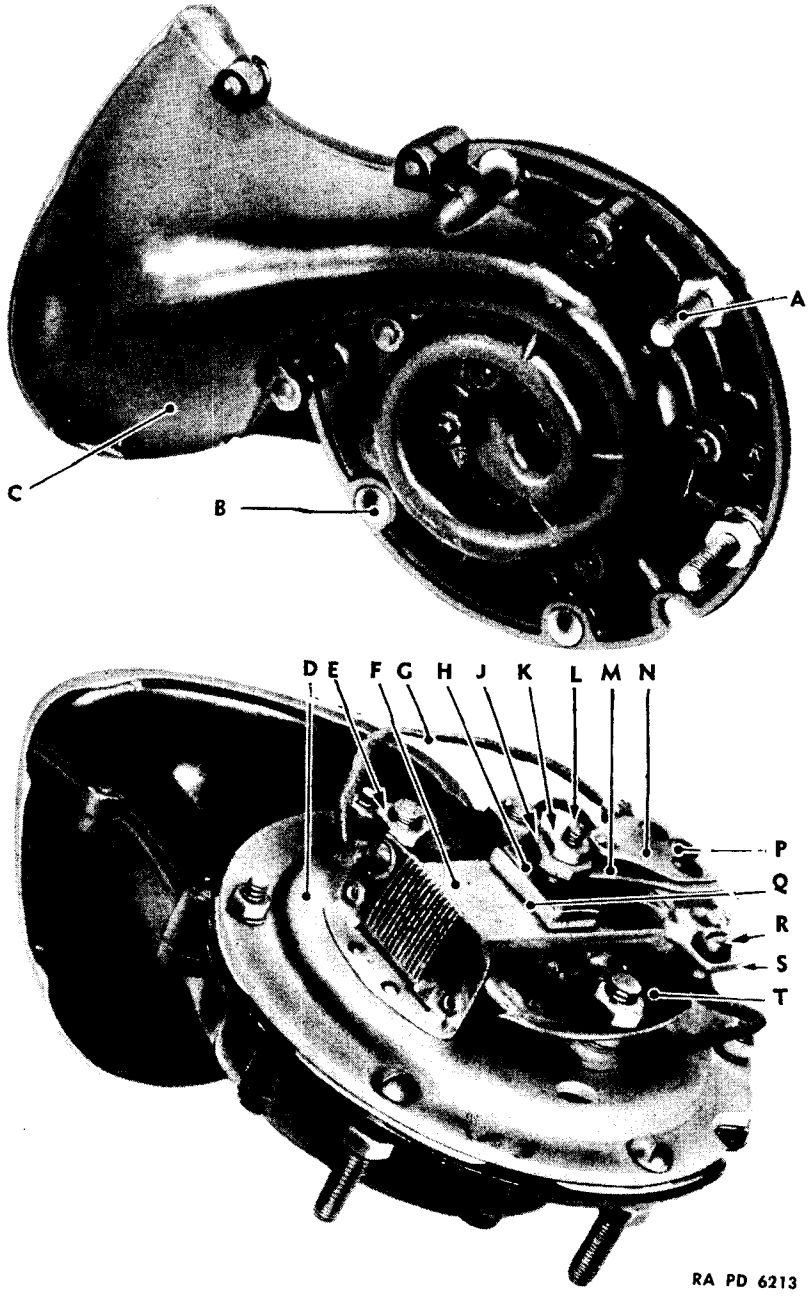


Figure 114A—Horn Assembly

ELECTRICAL LIGHTING SYSTEMS, BATTERIES AND ACCESSORIES

A — SCREW - DR-1865938
NUT - A214449
WASHER, LOCK - DR-103319

B — SCREW - DR-1853970
WASHER, LOCK - 118874
NUT - DR-1843521

C — COLLAR, ASS'Y - LOW NOTE - DR-1878615
HIGH NOTE - DR-1878618

D — NUT - DR-821204

E — LEAD, ASS'Y - DR-1885891

F — ARMATURE - DR-1864082

G — NUT - DR-1842784

H — NUT, LOCK - DR-120614

J — STUD - DR-1872634

K — INSULATION - DR-1858675

L — SUPPORT & POINT, ASS'Y - DR-1861054

M — RIVET - DR-1875430

N — SCREW - DR-1864099
WASHER, LOCK - DR-802729

P — CONNECTOR - DR-1858677

Q — COIL, ASS'Y - DR-1874660

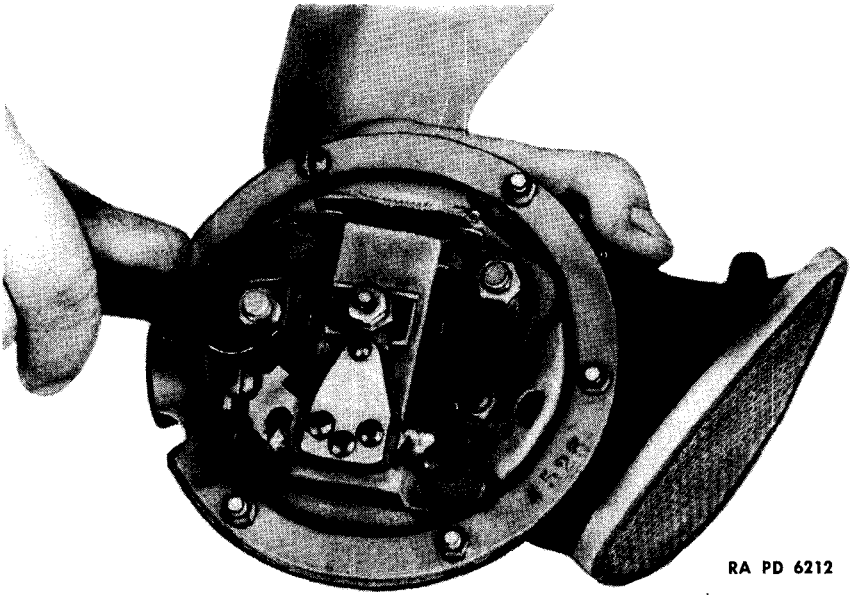
R — NUT - DR-1872408

S — PLATE - DR-1874156

RA PD 6213A

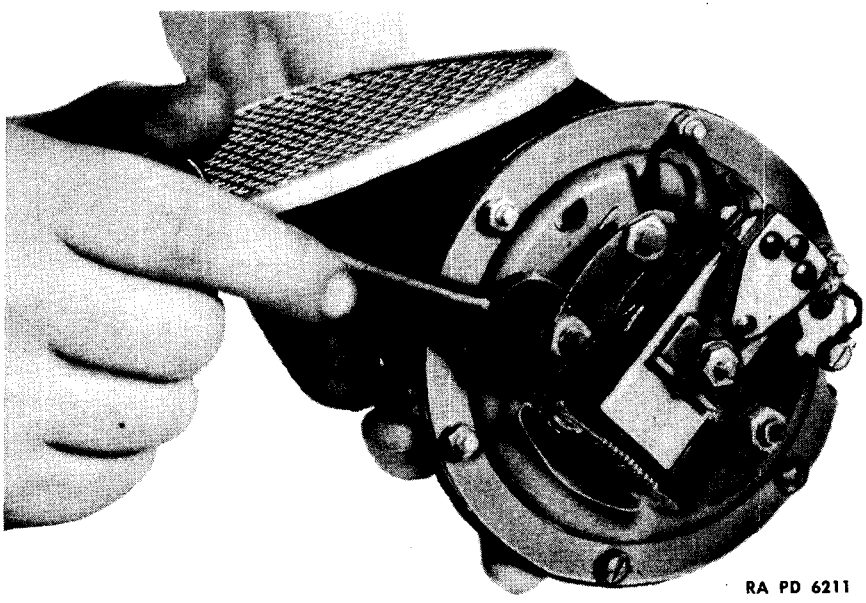
T — BASE, ASS'Y - DR-1880532

Figure 114B—Horn Assembly—Nomenclature



RA PD 6212

Figure 115—Horn Air Gap Adjustment



RA PD 6211

Figure 116—Horn Air Gap Adjustment

(4) CONNECT DIAPHRAGM TO ARMATURE STUD.
Wrench, open-end, $\frac{7}{16}$-in.

Slip plain washer upon lower end of stud against shoulder. Add diaphragm washer, then thrust end of stud through center hole in diaphragm. Put on remaining diaphragm washer and lock washer. Replace nut.

(5) CONNECT ARMATURE STUD AT UPPER END TO VIBRATOR SPRING BEARING MOVABLE TERMINAL POINT.
Wrench, open-end, $\frac{3}{8}$-in. Wrench, open-end, $\frac{1}{2}$-in.
Put operating nut on upper end of armature stud. Screw down to engage terminal spring. Contact points must not be separated. Apply lock nut. Tighten both.

(6) CHECK POSITION OF POLE FACES FOR ARMATURE AIR GAP. Adjust pole assembly by setting nuts on base studs so that its three polar faces are about $\frac{1}{32}$ inch below armature.

(7) SECURE BASE ASSEMBLY WITH POLE-PIECE, COIL, ARMATURE, AND DIAPHRAGM TO COLLAR ASSEMBLY.
Screwdriver Wrench, open-end, $\frac{5}{16}$-in.
Apply four screws, four lock washers, and four nuts, and tighten.

(8) REPLACE SCREEN AND BAND OVER MOUTH OF COLLAR ASSEMBLY.
Pliers
"Stake" or press band in six places over rim of collar assembly.

(9) ATTACH BRACKET TO TOP OF BASE. Engage ends of bracket with notches in base.

g. Installation of Assembly.
Screwdriver

(1) MOUNT UNIT ON SUPPORT BRACKET.
Screwdriver.
Insert two mounting screws through holes in base and collar assembly and in bracket. Replace two lock washers and nuts.

(2) CONNECT CABLE.
Screwdriver
Set terminal in place, and replace screw and lock washer.

38. HEAD LAMPS.

a. Description. The head lamps are mounted on the front fenders with separate brush guards to protect the lenses. Each lamp body houses a reflector and an electric lamp with two filaments, one for the upper beam and the other for the depressed beam. The controlling

device for the depressed beam is a foot dimmer switch on the floor near the foot pedals of the vehicle.

(1) CONSTRUCTION (fig. 117).

(a) The casing or body has a threaded stud which enters an inclined adapter on top of the fender and is held in place by a nut and washer under the fender. Inside the body is a reflector, which carries a double-filament electric lamp at its center. The reflector fits into the front of the body, against the rim, with a Cycleray lens set in front. The lens is supported and held tight by retaining springs or clips in a split molding with a binding screw at the bottom. A clip in the door locates the lens in correct position.

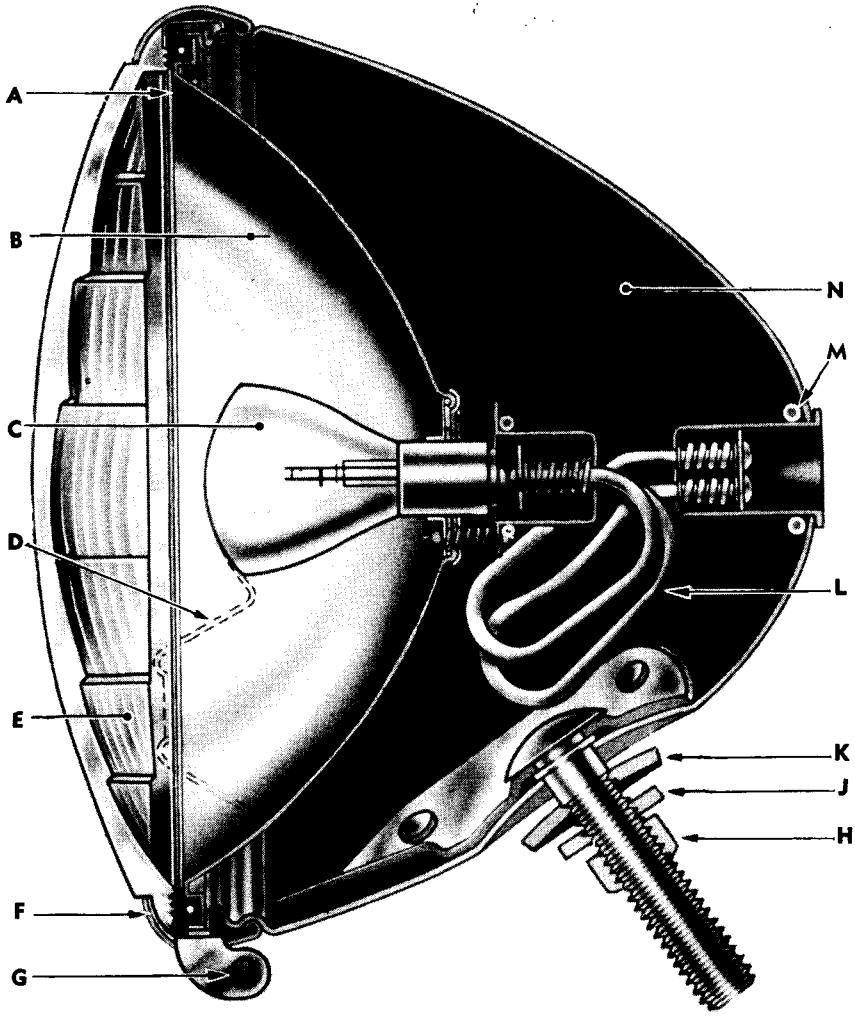
(b) Between the reflector and the back of the casing is the interior wiring assembly consisting of two sockets, one attached to the rear of the reflector in line with the lamp, and the other fastened in the rear end of the body, opening outward to receive the cable terminal plug. Each socket contains two contact points. In the socket on the reflector, each point engages with a terminal of one of the filaments in the lamp, the remaining terminals of the filament being grounded. Two separate leads connect each contact point in this socket to one of the points in the rear socket, thus providing independent connections for the filaments to the supply circuit.

(2) OPERATION. When the lighting circuits are closed by movement of the main switch on the dash, the circuit is closed through lower filaments of the lamps. The upper beam is then projected from the lamps. This beam is for use on unlighted highways outside of towns. When passing an approaching car or in towns or cities, the foot switch should be used to bring the depressed beam into play.

(3) SPECIFICATIONS.

Make	Guide Lamp	Ordnance No.	C85584
Type	Cycleray	White No.	368513
Model	364-G	Autocar Co.	16W4460
Manufacturer's No.	GL-925094	Diamond T No.	N7493

Operating voltage	12-16 volts
Electric lamp	2 filament double contact
Mounting	Detachable
Candle power	21-31
Size of lens	6¼ inch
Lens and retaining ring	Removable
Reflector	Removable
Wire assembly	Non-detachable from casing unless wires are disconnected.



A — GASKET - B167625
B — REFLECTOR - B184212
C — LAMP, ELECTRIC - A186626
D — SPRING - B185237
E — LENS - C74114
F — MOLDING, ASS'Y - B167672
G — SCREW - A214596
H — NUT - BBBX1D
J — WASHER, LOCK - BECX1L
K — WASHER - B167623
L — WIRING, ASS'Y - B167627
M — SPRING - B151373
N — BODY, ASS'Y - C85606

RA PD 54074

Figure 117—Head Lamp Assembly—Sectionalized

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) FAILURE TO ILLUMINATE WITH MAIN SWITCH IN SERVICE POSITION.	
Burnt out lamp.	Replace lamp.
Battery disconnected or terminals corroded.	Check battery cables and repair or replace.
Battery exhausted.	Recharge battery.
Dimmer switch inoperative.	Check and adjust dimmer switch and make sure connections are correct.
Broken or grounded connection.	Check insulation on wires in circuit to main switch and 20-ampere fuse on fuse block.
Main switch out of order.	Repair or replace switch.
(2) FAINT ILLUMINATION.	
Lenses dirty.	Remove and clean lenses.
Reflector tarnished.	Remove and polish.
Electric lamps blackened inside.	Replace lamps.
Battery weak.	Recharge battery.
Low voltage at bulb socket.	Check with voltmeter and correct.
Loose defective or corroded connection in wiring circuit.	Check and repair.
Corroded or loose battery terminals.	Check, clean, and tighten.
Defective connections and high resistance at light switch.	Clean and tighten all parts.
Poor contact of lamps in sockets.	Insert bulbs into sockets correctly.
(3) LAMPS GOING OFF AND ON OR FLICKERING.	
Loose wire or ground connection.	Check wires and insulation, repair, and tighten.
(4) LAMPS DIMMING AS ENGINE SPEEDS UP.	
Wires reversed at generator.	Check generator leads.
(5) ILLUMINATION TOO BRIGHT AND BULBS BURNING OUT.	
Loose or corroded wire connection at generator, ammeter, or battery.	Check, clean, and tighten wire and terminals.
Faulty operation of current and voltage regulator.	Check and adjust regulator coil armatures.

(6) BEAMS DISTORTED OR DIVERTED.

Bent or sprung reflector.	Replace reflector.
Lamps improperly mounted.	Adjust and aim correctly.
Lamp turned in socket.	Remove and reinsert with top uppermost.

c. Removal of Assembly (fig. 118).

Wrench, open-end, 5/8-in.

(1) DETACH CABLE.

Twist plug by hand, and extract from socket at rear of casing.

(2) DISMOUNT FROM FENDER.

Wrench, open-end, 5/8-in.

Remove one nut, lock washer, and one bearing washer from stud on underside of fender, and lift off head lamp.

d. Disassembly (fig. 119).

Screwdriver
Pliers, cutting

(1) REMOVE MOLDING.

Screwdriver

Remove one screw at bottom of retaining ring. Detach retaining ring. Detach retaining molding and lens.

(2) SEPARATE LENS FROM MOLDING.

Pull out two lens retaining springs and remove lens from molding.

(3) REMOVE ELECTRIC LAMP.

Turn and pull out electric lamp.

(4) REMOVE REFLECTOR.

Take reflector out by hand.

(5) LIBERATE SOCKETS.

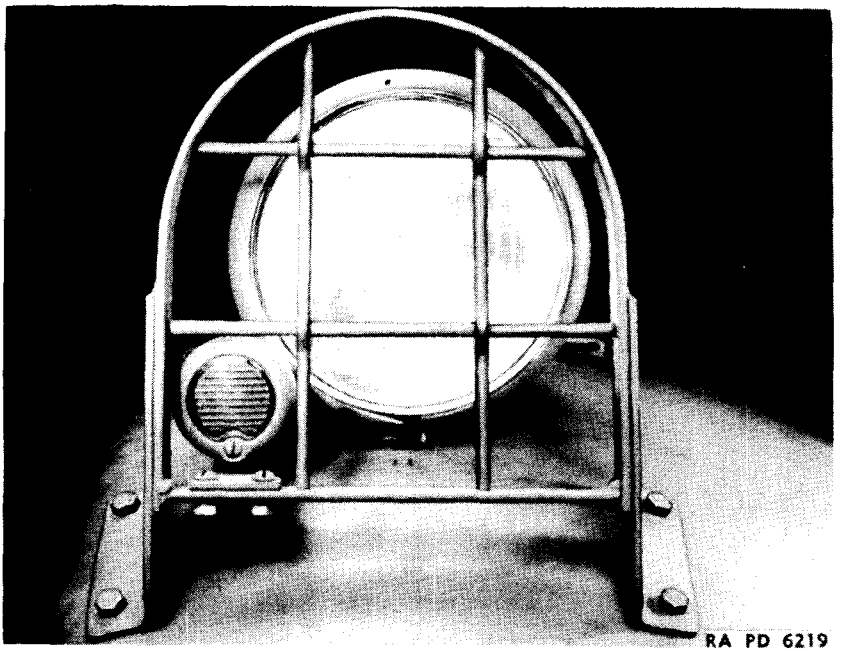
Pliers, cutting
Screwdriver

Push wires out and cut terminals off wire assembly in one socket, preferably the rear one. Withdraw wires at open end. Recover two springs and insulating socket washer. With screwdriver, loosen retaining spring on rear socket in casing, and push socket out at rear. Pull front socket mounting pins by hand out of notches in edge of central opening of reflector, and dismount from socket.

e. Maintenance and Adjustments.

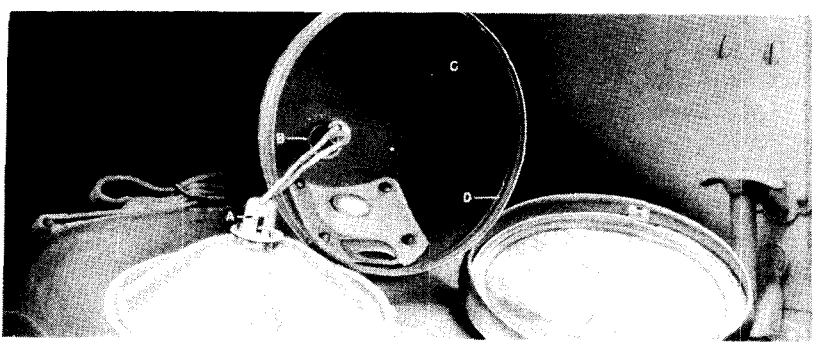
(1) Keep lenses clean, and replace electric lamps when the bulbs begin to turn dark or black inside. Polish reflectors with a soft cloth, and rub from rim to center. Do not use an abrasive. Replace reflector if sprung or bent.

(2) ADJUSTMENT.



RA PD 6219

Figure 118—Head Lamp—Installed



A — WIRING, ASS'Y - GL-5930332

B — SPRING - GL-912825

C — BODY, ASS'Y - GL-5932226

D — GASKET - GL-921789

RA PD 3467A

Figure 119—Head Lamp Details

(a) The focus of each head lamp is fixed. Adjustment of head lamps can best be made with head lamp tester. If no tester is on hand, place vehicle with head lamps 25 feet from a smooth vertical surface such as a wall or door, preferably of light color (fig. 120). The center line of the vehicle should be perpendicular to this vertical surface. Draw a horizontal line on the vertical surface three inches lower than the height of lamp centers above the floor. Locate a midpoint on this horizontal line at which projected center line of chassis intersects. Measure distance between lamp centers and divide this distance equally on the horizontal line at either side of midpoint. Then draw two vertical lines across the horizontal line directly ahead of each lamp center.

(b) The inclined adapter or bracket piece between the head lamp and the fender has a rounded top fitting against a concave seat on the bottom of the casing, and a bore larger than the thickness of the supporting stud affixed to the casing. Thus the adapter has a little play on

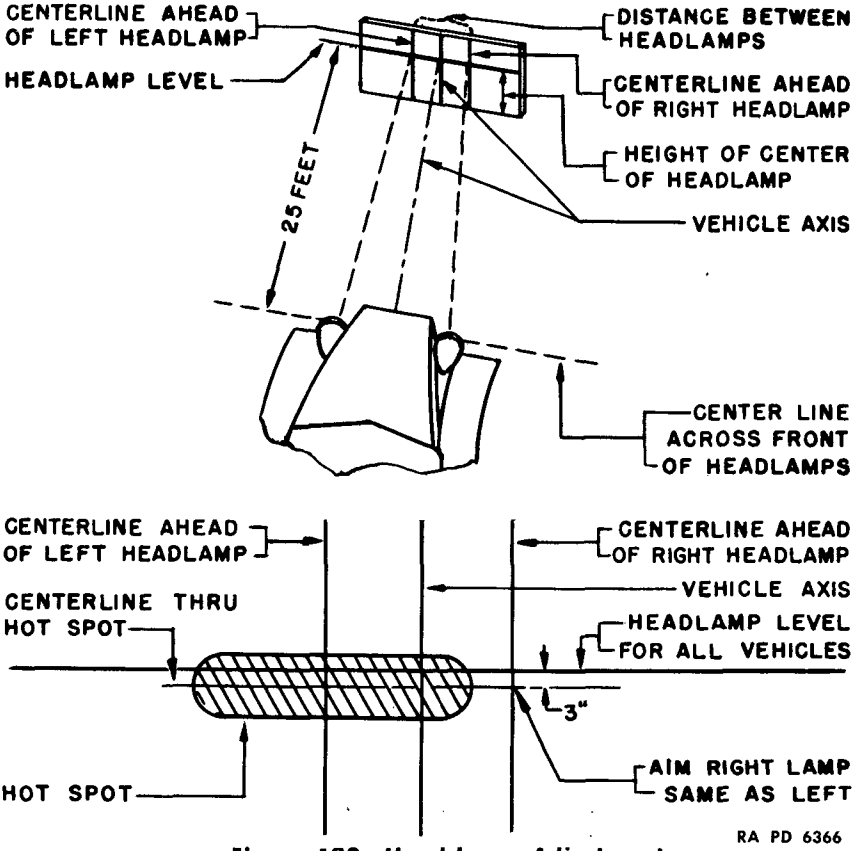


Figure 120—Head Lamp Adjustment

the stud when loose. If the nut on the stud is unscrewed a bit, the adapter can be pushed back and forth, so that the inclination of the head lamp is changed slightly when the nut is tightened again. Switch on high beams in head lamps, and cover one lamp while adjusting the other. Loosen nut on lamp-supporting stud, and aim lamp so that beam registers centrally with horizontal lines at point of intersection of this line and the vertical line on that side. Then tighten nut securely, taking care not to change location of beam pattern on vertical surface. After lamp is alined, cover its beam and proceed in same manner with opposite lamp.

f. Reassembly.

Copper, soldering
File, fine
Screwdriver, medium-sized
Wrench, open-end, 5/8-in.

(1) ASSEMBLE WIRE ASSEMBLY.

Copper, soldering
File, fine

Put rear socket into rear end of lamp. Attach circular retaining spring. Push wires through bottom of rear socket and out beyond open end. Put on encircling springs and insulation in socket washer, and solder ends of leads on disk. Smooth off with file to insure even level. Draw in springs and insulator disk. Attach reflector socket by pulling pins into notches in edge of hole at center of reflector.

(2) REPLACE ELECTRIC LAMP.

Hold lamp with top uppermost, insert into opening at middle of reflector, and turn till narrow part of slots are behind spring pressed heads on pins carried by front socket.

(3) REPLACE REFLECTOR.

Fit reflector snugly into front of lamp.

(4) PUT LENS INTO MOLDING.

Place lens into molding and secure with two lens retaining springs.

(5) MOUNT MOLDING AND LENS ON LAMP.

Screwdriver, medium-sized

Put molding with lens on front of casing. Adjust with lens locator and secure with one screw.

g. Installation.

Wrench, open-end, 5/8-in.

(1) MOUNT LAMP ON FRONT FENDER.

Wrench, open-end, 5/8-in.

Push shank on lamp down through adapter. Replace bearing washer, lock washer, and nut.

(2) CONNECT CABLE. Insert terminal plug in lamp body socket at rear.

39. MARKER LAMPS.

a. Description. The two marker lamps are mounted on the head lamp brush guards on the front fenders.

(1) CONSTRUCTION (fig. 121). A clear glass lens, a louver, and a blue filter are mounted in front of the electric lamp by a rubber gasket, door assembly, and retaining screw.

(2) OPERATION. The marker lamps are lighted when the light switch is in its intermediate or blackout position. The louver directs the light downward, making it invisible, from above.

(3) SPECIFICATIONS.

Early model

Make	Guide Lamp	Autocar No.	16W43050
Type	Blackout	Diamond T No.	N3493
Model	5502-B	Late model	
Manufacturer's No.	GL-916388	Make	Guide Lamp
Ordnance No.	C85572	Type	Blackout
White No.	368518	Manufacturer's No.	GL-917085

Lens size	1⅞ in.
Electric lamp	3 cp, S. C., Mazda
Operating voltage	12 volts

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) FAILURE TO LIGHT WHEN OTHER LAMPS LIGHT	
Burned out lamp.	Replace.
Broken or grounded lead.	Repair or replace lead.
Lamp loose.	Seat electric lamp properly.
(2) LAMPS DIM	
Lamps loose.	Seat electric lamp.
Electric lamp blackened.	Replace.
Poor connection at socket.	Repair.
Ground leak.	Repair.
(3) FLICKERING LAMPS.	
Loose wire.	Repair or tighten.
Intermittent ground.	Repair.

c. Removal of Assembly.

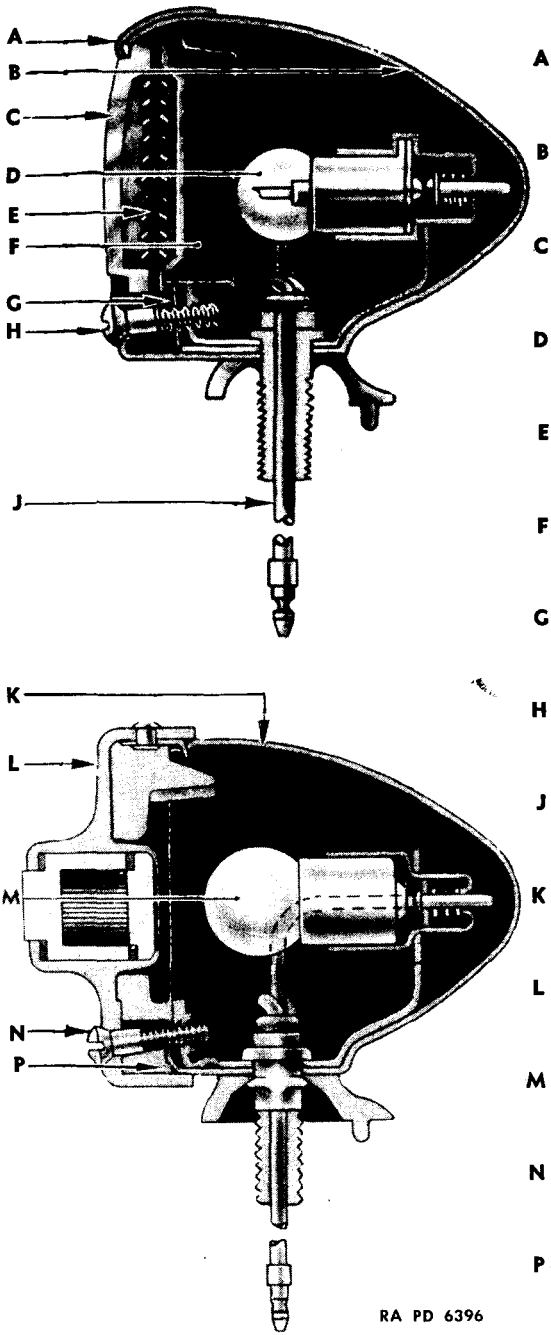
Wrench, open-end, ½-in.

(1) DISCONNECT CABLE. Pull end of cable out of connector under front fender.

(2) DISMOUNT LAMP FROM HEAD LAMP GUARD.

Wrench, open-end, ½-in.

Remove nut and lock washer and remove lamp.



A — DOOR, ASS'Y - A214554

B — BODY, ASS'Y - A214556

C — LENS - B184206

D — LAMP - A214551

E — LOUVRE, ASS'Y - A214552

F — FILTER - A214550

G — GASKET - A214553

H — SCREW - A214555

J — WIRING, ASS'Y - A214594

K — BODY, ASS'Y - GL-5932256

L — COVER, ASS'Y - GL-5933122

M — LAMP - GL-142450

N — SCREW - GL-5932419

P — GASKET - GL-5933075

Figure 121—Marker Blackout Lamp Assemblies—Sectionalized

d. Disassembly of Components.

Screwdriver

(1) REMOVE DOOR ASSEMBLY.

Screwdriver

Remove door screw and dismount door.

(2) REMOVE RUBBER GASKET, LENS FILTER, LOUVER AND ELECTRIC LAMP. Remove lamp, gasket, filter, louver, lens.

e. Maintenance. If lamp is blackened or burnt out, replace bulb. Clean lens, filter and louver. Check lead and make sure its terminal is engaged firmly in connector to circuit beneath fender.

f. Reassembly of Components, Both Lamps.

Screwdriver

(1) REPLACE ELECTRIC LAMP. Mount lamp in socket by hand.

(2) REMOUNT GASKET WITH LENS FILTER AND LOUVER. Replace parts by setting in place.

(3) REPLACE DOOR ASSEMBLY.

Screwdriver

Set door in place, replace screw, and tighten.

g. Installation.

Wrench, open-end, ½-in.

(1) MOUNT LAMP ON SUPPORT PLATE OF HEAD LAMP GUARD.

Wrench, open-end, ½-in.

Set lamp in place, and replace nut and lock washer.

(2) RECONNECT LEAD IN CIRCUIT. Insert snap terminal on lead into connector beneath fender.

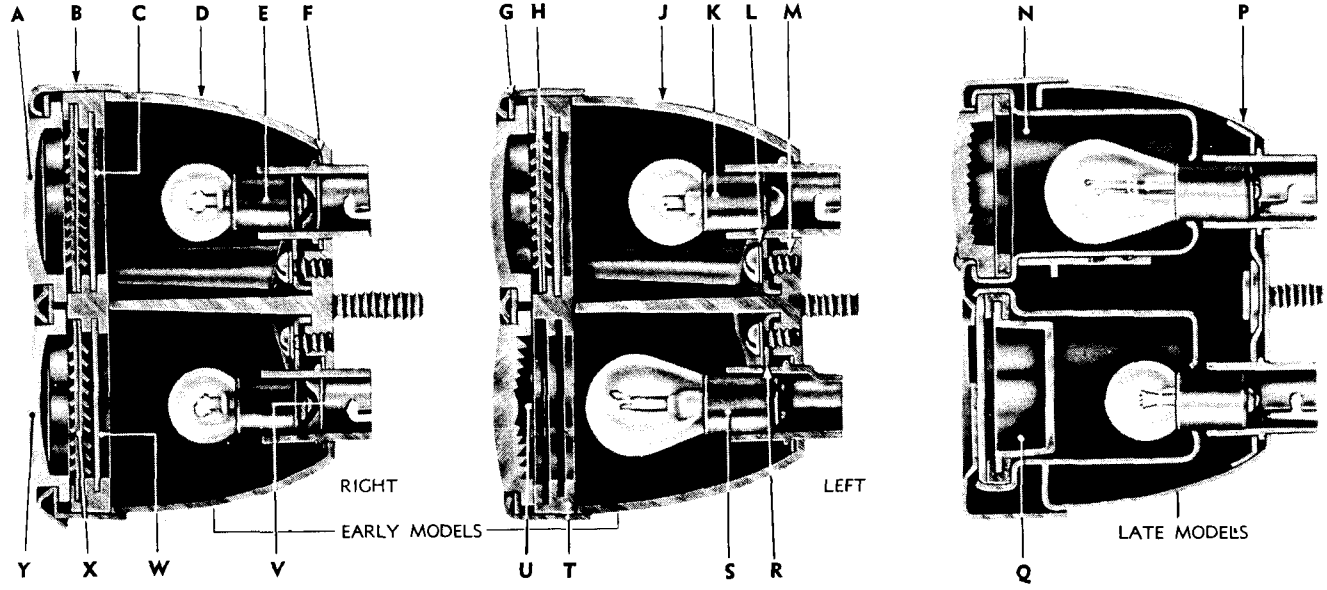
40. TAIL LAMPS.

a. Description. The left-hand tail lamp is the service stop light, service taillight and blackout taillight. The right-hand tail lamp is the blackout stop light and blackout taillight.

(1) CONSTUCTION (fig. 122).

(a) The body or casing of the left-hand lamp houses two electric lamps, the upper containing a single filament and being one of the blackout taillights, and the lower containing two filaments and being the combination service taillight and service stop light. The latter has a transparent ruby lens in front of it. The upper lamp projects its rays out through a clear lens having a central vertical black band across its face and a ruby filter behind it. Between the clear lens and the ruby filter is a louver plate or blackout screen arranged to prevent light from going in an upward direction. A horizontal partition in the casing between the two lamps separates the casing into two compartments. The upper is blackened over its whole inside surface.

(b) The casing of the right-hand lamp mounts two electric lamps, one upper and one lower, each having a single filament. Between them is a partition dividing the casing into chambers, both of which are black-



A — LENS - A214565
B — DOOR - B184207
C — FILTER - A-214564
D — BODY, ASS'Y - B184210
E — LAMP- A186607
F — GASKET - A214561
G — GASKET - A214558
H — LOUVRE, ASS'Y - B184209
J — BODY, ASS'Y - B184205
K — LAMP- A214551
L — WASHER, LOCK - A214563
M — SCREW - A214560
N — LENS, ASS'Y - GL-5933302
P — CASING, ASS'Y - GL-5933810
Q — LENS, ASS'Y - GL-5933305
R — RETAINER - A214562
S — LAMP- A169266
T — HOLDER, FILTER - B184208
U — LENS - A214557
V — SLEEVE - A214566
W — FILTER - A214568
X — LOUVRE, ASS'Y - B184211
Y — LENS - A214567

RA PD 3577A

Figure 122—Tail Lamp Assemblies—Sectionalized

ened on the interior. Over the upper lamp is a clear lens with vertical black band across it and a ruby filter behind it. The lens for the lower lamp is entirely clear with an amber filter behind it. Between the lamps and both filters is a blackout screen or louver plate to direct the light downward as it emerges. For both casings the lenses are mounted one above the other in a ring-shaped door for the casing. A round rubber holder carriers the lenses, filters and louver plates, and is pressed into the door so as to hold the lenses against their seats round the edges of the lens openings. Screws hold the doors in place.

(2) OPERATION.

(a) When the head lamps are in circuit, the service tail lamp is lighted in the lower part of the left-hand casing. The circuit is made through the less emmissive or dimmer filament of the lower lamp. When the brakes are applied, a circuit is completed to the other filament of the same lamp by means of the hydraulic stop light switch on the master cylinder of the brake system. The lower lamp then brightens, giving the stop signal.

(b) When the main switch is moved to blackout position, the head lamps and service taillight and stop light are cut out; and the marker lamps and the blackout tail lamps in the upper compartments of both tail casings are connected in circuit. When the brake pedal is depressed, the stop light switch is actuated, and circuit is completed to the blackout stop light in the lower compartment of the right tail lamp.

(3) SPECIFICATIONS.

Early model

Make	Guide Lamp
Type	Blackout
Model	
L. H.	3006-C
R. H.	3006-B
Manufacturer's No.	
L. H.	GL-927181
R. H.	GL-927182
Ordnance No.	
L. H.	C85533
R. H.	C85532
White No.	
L. H.	368520
R. H.	368519
Autocar No.	
L. H.	16WA4400
R. H.	16W4400
Diamond T No.	
L. H.	N1493
R. H.	N2493

Later model

Make	Guide Lamp
Type	Blackout
Manufacturer's No.	
L. H.	GL-927265
R. H.	GL-927266
Ordnance No.	
L. H.	C85787
R. H.	C85786
White No.	
L. H.	392499
R. H.	392470
Autocar No.	
L. H.	16WC4400
R. H.	16WB4400
Diamond T No.	
L. H.	N10493
R. H.	N11493

Left-hand tail and stop lamp:
Lower electric lamp DC 21-6 CP—A169266
Upper electric lamp S.C. 3 CP—A214551
Right-hand tail and stop lamp:
Electric lamps S.C. 3 CP—A186607
Operating voltage 12-16 volts
Both casings demountable
Ring-shaped doors removable
Lenses, filters, louver plates, rubber holders, and gaskets detachable
Electric lamps and sockets detachable.

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) FAILURE TO ILLUMINATE WHEN OTHER LAMPS LIGHT.	
Burnt out lamp.	Replace.
Break or ground in circuit.	Check connections back to switch.
Stop light switch impaired.	Check and replace if necessary.
Lamp loose or improperly mounted in socket.	Make sure lamp terminals engage socket terminals firmly.
(2) LAMPS DIM.	
Lamps loose or incorrectly mounted in sockets.	Push lamp fully into socket.
Electric lamp blackened.	Replace bulb.
Poor connections at socket, or ground leak.	Check socket, circuit, and insulation.
(3) LAMPS GO OUT AND THEN ON AGAIN OR FLICKER.	
Loose wire connection or intermittent ground.	Check wires and insulation, repair, and tighten.

c. Removal of Assembly.

Wrench, open-end, $\frac{7}{16}$-in.

(1) DETACH RIGHT-HAND AND LEFT-HAND LAMPS FROM VEHICLE.
Wrench, open-end, $\frac{7}{16}$-in.
Remove two nuts and two lock washers holding each lamp in place.

d. Disassembly of Components.

Screwdriver

(1) DETACH RING-SHAPED DOOR FROM FRONT OF CASING.
Screwdriver
Remove two screws at front. Take doors off left-hand casing and right-hand casing.

(2) REMOVE FILTER HOLDERS AND LENSES FROM DOORS.

Push out with fingers: lower ruby lens, upper clear lens and rubber filter holder from door of left-hand lamp, and lower clear lens, upper clear lens, and rubber filter holder from door of right-hand lamp.

(3) REMOVE GASKETS FROM DOORS. Take gaskets out of doors by hand.

(4) REMOVE FILTERS AND LOUVER PLATES FROM FILTER HOLDERS. Push out by hand: Louver plate and ruby filter from holder of left-hand lamp, and louver plate, upper ruby filter, and lower amber filter from holder of right-hand lamp.

(5) REMOVE ELECTRIC LAMPS FROM CASTINGS. Turn and pull out by hand, upper and lower electric lamps from right-hand casing, upper electric lamp and lower electric lamp of left-hand casing.

(6) REMOVE LAMP SOCKETS FROM CASINGS.

Screwdriver, medium-sized

Remove one screw and one lock washer at each socket; take out socket retainer.

e. Maintenance.

(1) If blackened or burnt out, replace electric lamp. Clean lenses, filters, and louvers. Check leads and make sure plug and wire terminals are engaged firmly in sockets at casings, to connectors under body, and to circuit points on switches and junction block.

(2) If stop lights do not illuminate in braking, first make sure electric lamps are good; then test stop light switch as follows: Connect one lead of voltmeter to each terminal of switch. With brakes off, instrument should read battery voltage. With brakes on, voltage should be zero. If either of these readings are not obtained, replace switch with new one.

f. Reassembly of Components.

Screwdriver, medium-sized

(1) REMOUNT LAMP SOCKETS IN CASINGS.

Screwdriver, medium-sized

Insert two sockets in each casing, and attach four retainers by means of four lock washers and four screws.

(2) INSERT ELECTRIC LAMPS IN CASINGS. Push in and turn by hand upper and lower electric lamps of right-hand casing and upper electric lamp and lower electric lamp of left-hand casing.

(3) PLACE GASKETS AND LENSES IN CASINGS. Turn doors so that the semicircular half having screw holes is in top position. Lay two gaskets in doors, making screw holes register. By hand put in right-hand lamp:

clear lens with vertical central dark band in upper opening and entirely clear lens in lower opening; and put in left-hand lamp: ruby lens in lower opening and clear lens with vertical central dark band in upper opening.

(4) ASSEMBLE FILTERS AND LOUVER PLATES IN FILTER HOLDER. Turn filter holders so that semicircular half having screw holes is in top position. At the rear face holder for right-hand lamp, insert ruby filter in upper opening and amber filter in lower opening, and then place louver over filters, making screw holes register. For the left-hand lamp, insert ruby filter into upper opening and place louver over filter, making screw holes register.

(5) ASSEMBLE HOLDERS AND DOORS. Replace holders in doors by hand, with screw holes registering with door screw holes. Present filters to rear of doors, louvers to front.

(6) PUT DOORS AND FILTER HOLDERS BACK ON FRONT OF CASINGS.
Screwdriver, medium-sized

Insert two screws into each door, and attach doors to casings, the door with red lens on the casing having one blackened compartment, the other door on the casing having two blackened compartments.

g. Installation.

MOUNT LAMPS ON VEHICLE.
Wrench, open-end, $\frac{7}{16}$-in.

Put lamp with red lens at left and other lamp at right; attach two lock washers and two nuts to studs on each casing, and tighten.

Section IX

FRAME

	Paragraph
Frame	41
Pintle and tow hooks	42
Roller	43
Bumpers	44

41. FRAME.

a. Description. The chassis (figs. 123 and 124) consists of channel sections braced and reinforced with pressed steel cross members. The frame is the structural center of the vehicle. It carries the vehicle load and furnishes support for the body, engine, and transmission.

b. Maintenance.

(1) ALINEMENT. Correct frame alinement is of great importance in operation of the vehicle. The chassis units will not function properly in a swayed or bent frame. Improper frame alinement, usually the result of an accident, places excessive strains on the various parts of the entire vehicle, affects wheel alinement, and causes unnecessary noises.

(a) In checking frame alinement, the various dimensions indicated on figure 125 should be considered. Diagonal measurements will quickly determine which section of the frame is bent and where force should be applied to restore correct alinement. The diagonal measuring should be performed with the greatest accuracy and care. Measurements may be taken without removing any part of the body from the chassis, by using a plumb bob and chalk line.

(b) Place vehicle on a level floor with all tires properly inflated.

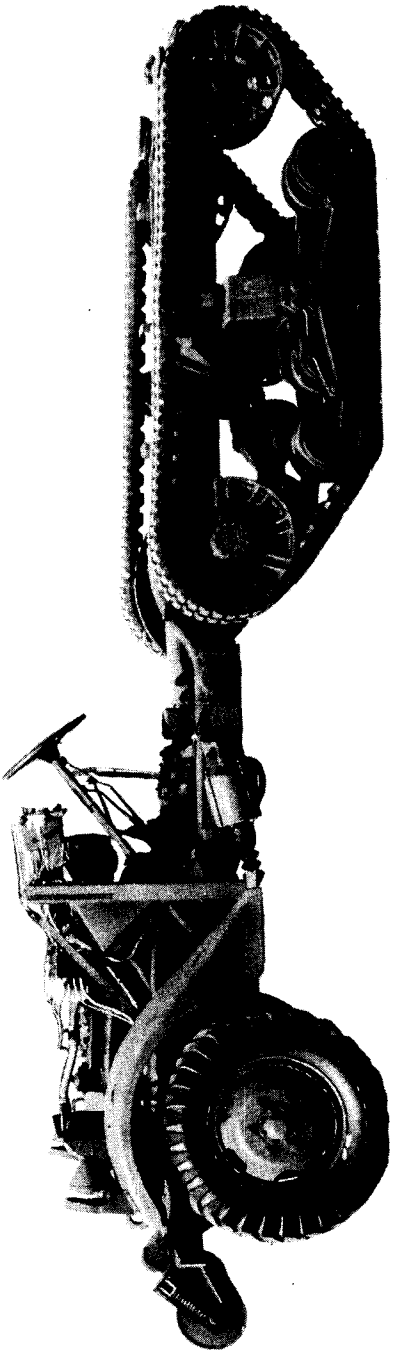
(c) Suspend a plumb bob from the various points on the frame shown on figure 125. The plumb bob should be suspended slightly above the floor. When it comes to rest, mark the floor directly underneath it.

(d) Move the truck so that the diagonal distances between the chalk marks can be measured.

(e) Measure the various diagonals. Corresponding diagonals should agree within ⅛ inch.

(f) CAUTION: Care should be taken to make sure that any two diagonals compared represent exactly corresponding points on each side of the frame.

(2) STRAIGHTENING. The use of heat is not recommended when straightening frames. Heat weakens the structural characteristics of



RA PD 3596

Figure 123—Vehicle Chassis—Elevation

frame members, and all straightening should be done cold. Frame members which are bent or buckled sufficiently to show strains after straightening should be replaced.

(3) CUTTING, REINFORCING, RIVETING, AND WELDING.

(a) Whenever it is necessary to cut the frame, the rail should be cut at an angle of 45 degrees. In other words, make the actual cut twice the width of the rail. This method distributes the cut and weld over a greater area than a cut made at right angles to the rail.

(b) Reinforcements can be made with flat, channel, or angle stock. Wherever possible the reinforcement should extend the entire length of the side rail or at least 18 inches beyond the driver's compartment cross member. This procedure, of course, may be impractical in some instances because of the position of attached units and existing cross members. The reinforcement thickness should not exceed that of the side rail to be reinforced.

(c) Whenever possible, parts should be securely riveted together. Hot rivets, if available, are preferred. Cold rivets should be used only where tools of sufficient power to set the rivets properly are provided. The diameter of the reinforcement rivets depends upon spacing and the number of rivets used. Generally, rivets should be from 50 to 100 percent as heavy in diameter as the total thickness of the plates to be riveted.

(d) Electric-arc welding is recommended for all frame work. Heat of the weld is localized, and burning of the material is minimized when this method is used. Outside edges of all reinforcements used to strengthen the frame should be welded to the frame after the reinforcements are riveted on. All unused holes should be filled with welding material.

42. PINTLE AND TOW HOOKS.

Towing facilities are provided at the front of the vehicle by two tow hooks and at the rear by a standard pintle (M7A2). The pintle (fig. 126) is attached to the frame rear cross member with an additional supporting A brace.

a. Pintle Removal. To remove pintle, pull out cotter pin, and remove nut and thrust washer. Sleeves and spring can be removed after hook has been withdrawn from the vehicle. Replace pintle in the reverse order.

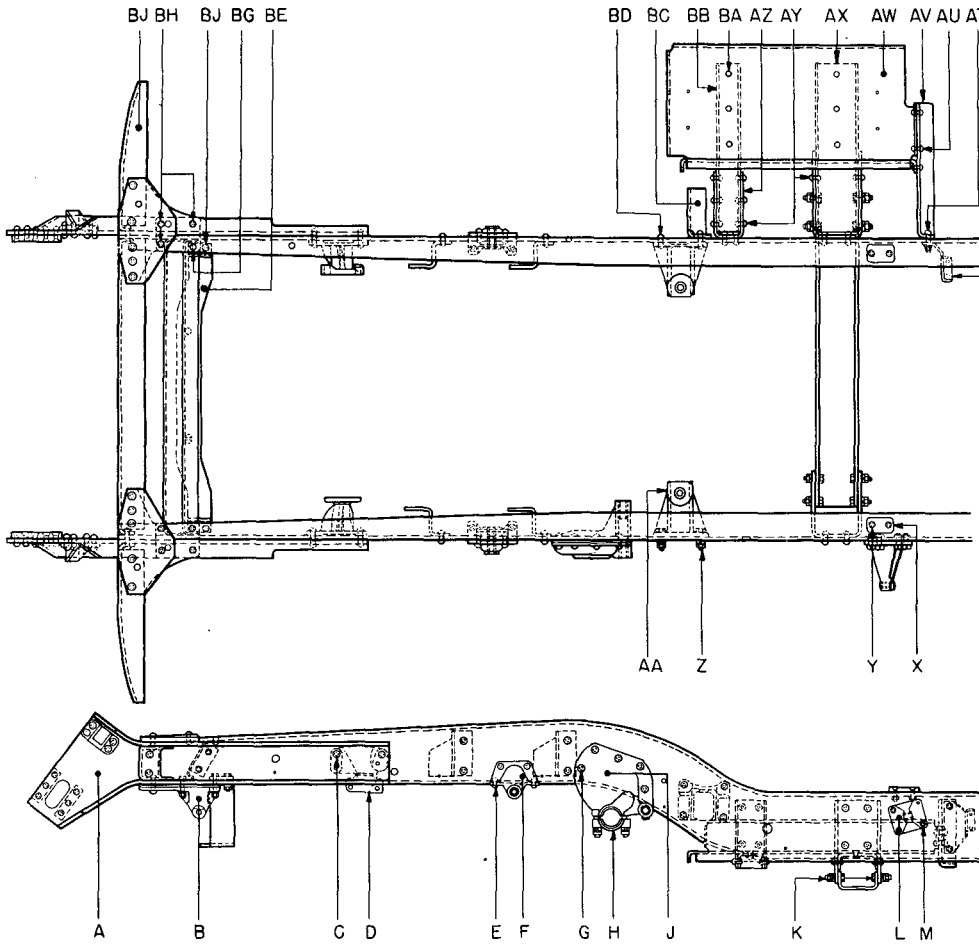
43. ROLLER.

a. Description (figs. 127 and 128).

(1) CONSTRUCTION.

(a) The roller is made of steel plate which is rolled to form a tube and has a welded seam. Two reinforcing rings, which are evenly spaced in the roller, are welded along their periphery to the inside of the roller. A circular plate, which has a reinforced tube welded to it at the center, is welded into each end of the roller.

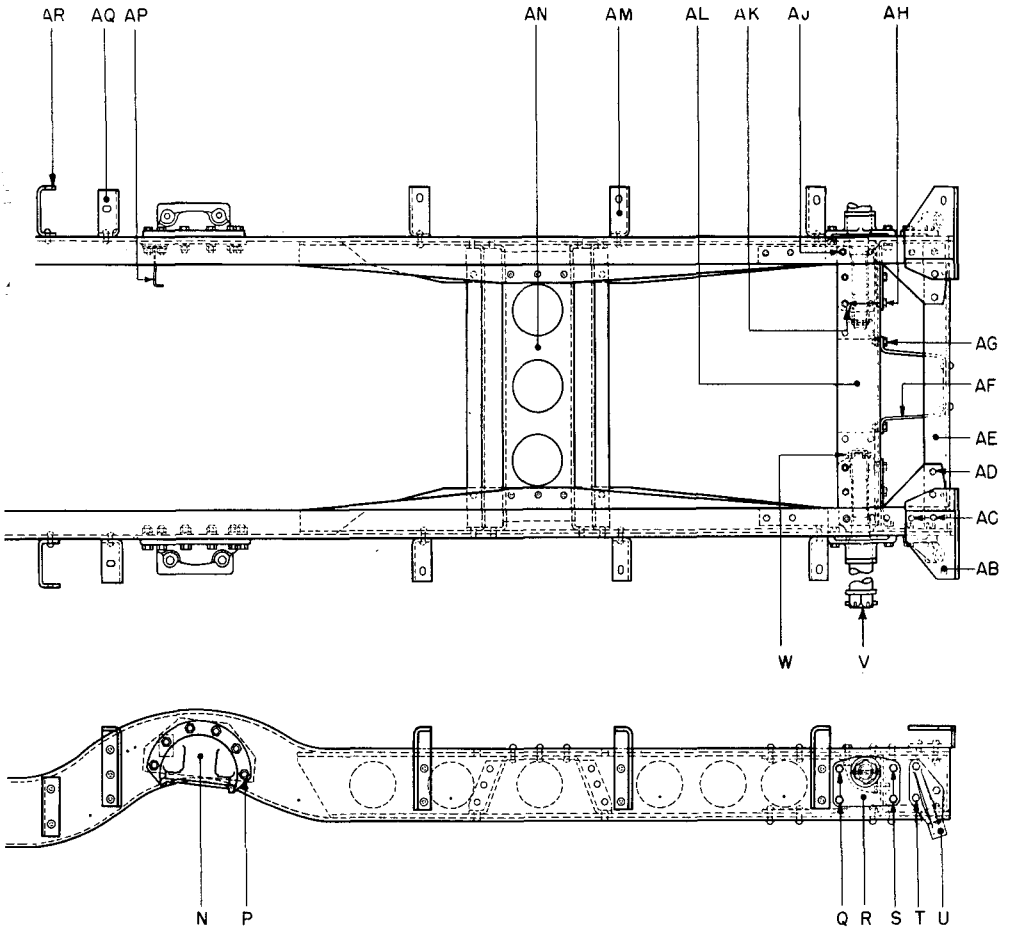
ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES



A - BRACKET - R.H. - D48110
L.H. - D48111
B - BRACKET - C85504
C - RIVET - BMCX2
D - SUPPORT - R.H. - C85507
L.H. - C85505
E - RIVET - BMCX1
F - BRACKET - C67494
G - RIVET - BMCX1
H - CAP - B184124
STUD - A186606
SHIM - A215358
BUSHING - A214312
NUT - BBBX2A
WASHER, LOCK - BECX1N
J - BRACKET, ASS'Y - D48103
K - SCREW, CAP - BCBX1ED
NUT - BBBX1E
WASHER, LOCK - BECX1M
L - BRACKET - C85531
M - SCREW, CAP - BCBX1DD
NUT - BBBX1D
WASHER, LOCK - BECX1L
N - BRACKET - D48400
P - BOLT - A215342
NUT - BBBX2B
WASHER, LOCK - BECX1P
Q - BOLT - A215335
NUT - BBBX2B
WASHER, LOCK - BECX1P
R - BRACKET - C86022
S - BOLT - A215331
NUT - BBBX2B
WASHER, LOCK - BECX1P
T - BOLT - A215344
NUT - BB133X2B
WASHER, LOCK - BECX1P
U - BRACKET - C86023
V - NUT - A215329
PIN, COTTER - BFAX2CF
W - NUT - A215329
PIN, COTTER - BFAX2CF
X - PAD - A214337
Y - SCREWS, MACH. - BCKX2DL
NUT - BBAX1B
WASHER, LOCK - BECX1H
Z - SCREW, CAP - BCBX1EF
NUT - BBBX1E
WASHER, LOCK - BECX1M
AA - BRACKET - D48106
AB - BRACKET - R.H. - C86026
L.H. - C86027
AC - SCREW, CAP - BECX1M
NUT - BBBX1E
WASHER, LOCK - BECX1M
SCREW, CAP - BCBX1EE

Figure 124—Vehicle Chassis Frame Assembly—Sectionalized

FRAME



AD - SCREW, CAP - BCBX1ED
NUT - BBBX1E
WASHER, LOCK - BECX1M
AE - CROSS MEMBER - C86001
AF - BRACE - B185104
AG - SCREW, CAP - BCBX1ED
NUT - BBBX1E
WASHER, LOCK - BECX1M
AH - BOLT - A215592
NUT - BBBX1E
WASHER, LOCK - BECX1M
AJ - BOLT - A215345
NUT - BBBX1E
WASHER, LOCK - BECX1M
AK - BRACKET - C86025
AL - CROSS MEMBER - C86003
AM - BRACKET - R.H. - B185106
L.H. - B185107
AN - CROSS MEMBER - D48401
AP - BRACKET - C85556
AQ - BRACKET - R.H. B185108
L.H. B185109
AR - BRACKET - B185110
AS - BRACKET - C85560
AT - SCREW, CAP - BCBX7DD
NUT - BBBX1D
WASHER, LOCK - BECX1C
AU - RIVET - BMCX1
AV - BRACKET - B184129
AW - TRAY - D48130
AX - CHANNEL - B184130
AY - RIVET - BMCX1
AZ - GUSSET - B167751
BA - RIVET - BMCX1
BB - CHANNEL - B167752
BC - SUPPORT - B184131
BD - RIVET - BMCX1
BE - STRAP - D48118
BF - BOLT - A215345
NUT - BBBX1E
WASHER, LOCK - BECX1M
BG - SCREW, CAP - BCBX1EE
NUT - BBBX1E
WASHER, LOCK - BECX1M
BH - BOLT - A215330
NUT - BBBX1E
WASHER, LOCK - BECX1M
BJ - BUMPERETTE - R.H. B184118
L.H. B184117

RA PD 3800

Figure 124—Vehicle Chassis Frame Assembly—Sectionalized

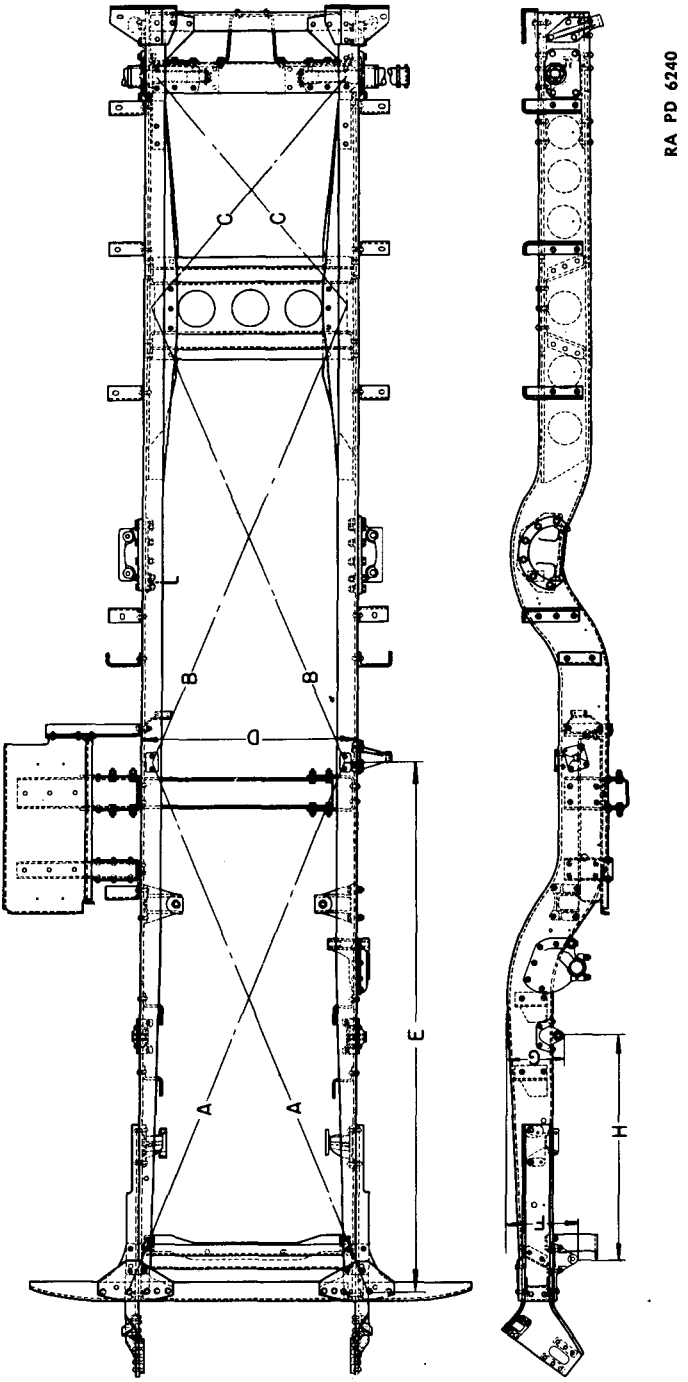


Figure 125—Vehicle Chassis Frame Alinement

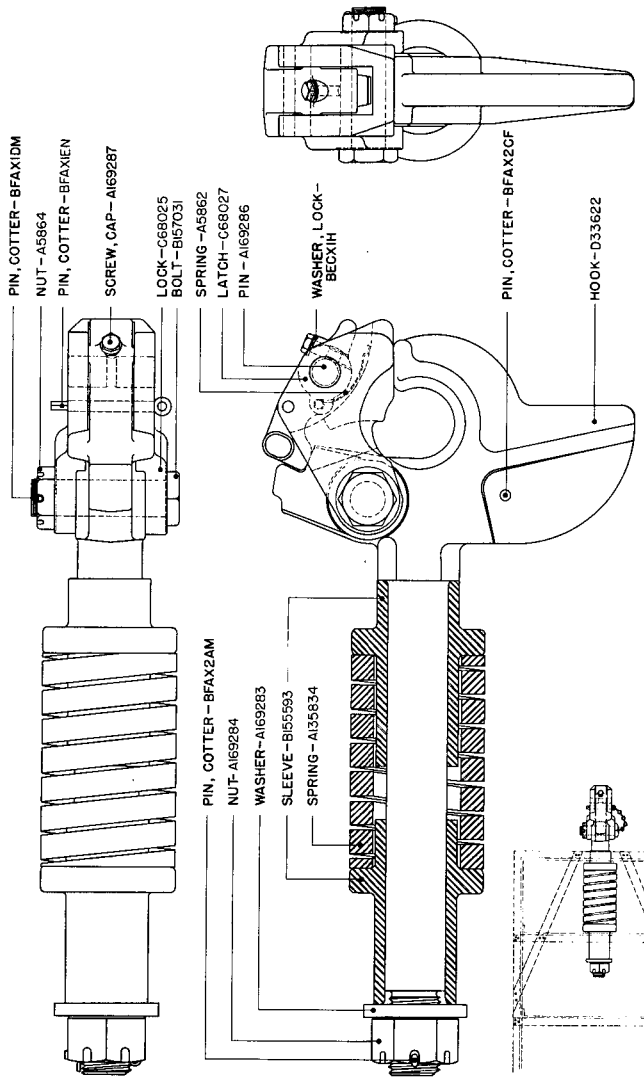


Figure 126—Vehicle Chassis Pintle—Sectionalized

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

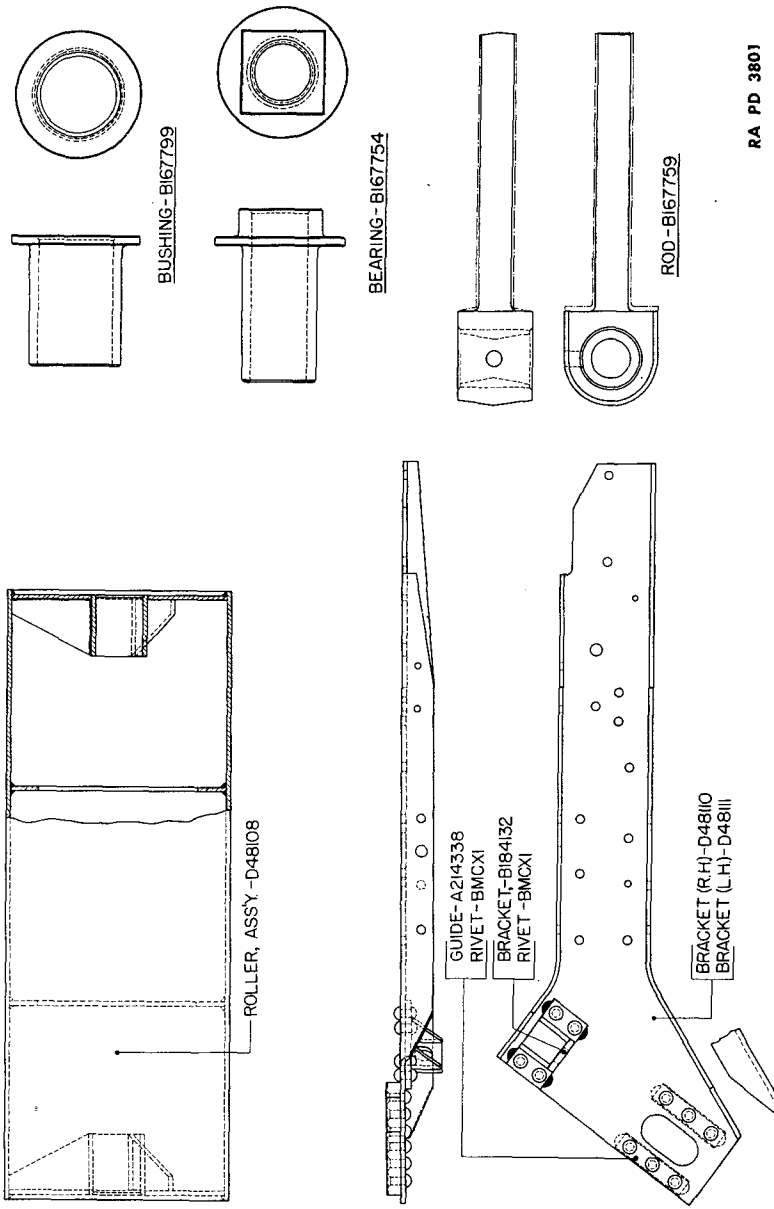


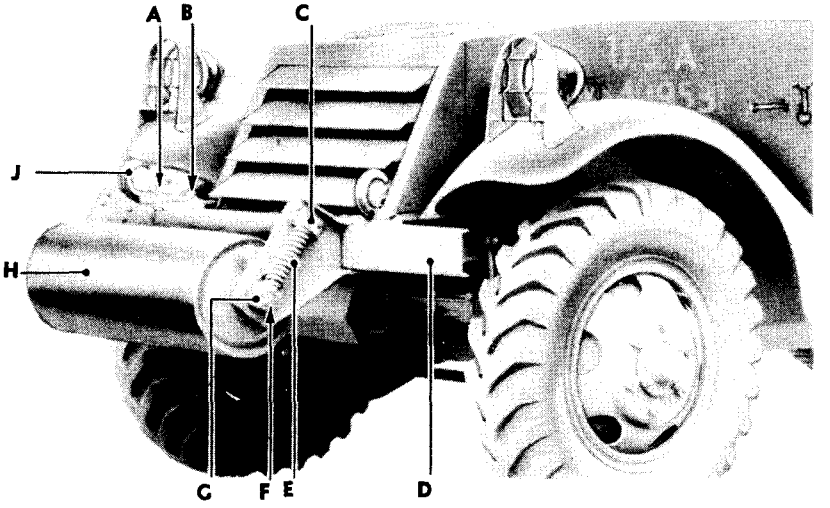
Figure 127—Vehicle Chassis Front Roller—Sectionalized

(b) A bushing is driven into each end tube and the supporting shaft bearings run in these bushings. Each bearing has a square shoulder at the outer end to act as a guide. It slides between the guide slides which are riveted to the roller support at each side of the slotted hole. The roller supports are riveted to the front of the chassis frame. Each support has a spring stop bracket riveted to it at the top and in line with the slotted hole.

(c) The roller shaft passes through the bearings and the slotted holes in the supports, and extends slightly beyond each support. The compression springs are carried by the guide rods and are compressed between the shoulder at the lower end of each guide rod and the spring stop brackets. The lower end of the guide rods slide onto the protruding ends of the roller shaft and are fixed to the shaft by means of tapered pins driven through the guide rod lower ends and shaft. The upper ends of the guides set into openings in the spring stop brackets.

(2) OPERATION.

(a) The roller is held in the forward and downward position of the slots by the compression springs. This provides a flexible joint at this point and allows the roller to move upwards and towards the rear when it strikes any object. The square shoulders of the bearings slide in the guide slides and keep the upward motion of the roller in a straight line;



A — SCREW - BCBX2CM
NUT - BBBX2C
WASHER, LOCK - BECX1R
SPACER - A175423

B — SCREW - BCBX2BE
NUT - BBBX2B
WASHER, LOCK - BECX1P
SPACER - A175423

C — BRACKET - B184132
D — BUMPERETTE (L.H.) - B184117
E — SPRING - B167758
F — SHAFT - A175420
G — GUIDE (ROD) - B167759
H — ROLLER, ASS'Y - D48108
J — HOOK - C67459 RA PD 7443

Figure 128—Vehicle Chassis Front Roller—Installed

they also prevent the bearings from turning, so that the roller bushings rotate on the bearings. The springs act as shock absorbers and relieve the frame from subjection to excessive strains.

(b) The roller is also provided to aid in maneuvering through ditches and holes. By striking the bank first and rolling, it prevents the front end of the vehicle from digging into the bank of the ditch or hole, thereby helping the vehicle to roll up over the bank.

b. Removal of Assembly.

Clamps, special, two, (fig. 129) — Rod, driving
Drift, steel — Wrench, socket, 1¼-in.
Hammer

(1) REMOVE TAPERED PINS HOLDING SPRING GUIDES TO SHAFT.
Drift, steel — Hammer
Drive tapered pins out of spring guide rods.

(2) COMPRESS ROLLER SPRING.
Clamps, special, two, (fig. 129) — Wrench, socket, 1¼-in.
Set clamps onto brackets and under guide rods as shown in figure 129. Compress springs by turning clamp screws until roller shaft no longer rests on supports.

(3) REMOVE ROLLER.
Hammer — Rod, driving
Support roller, and then drive out shaft. Lower roller assembly to ground.

c. Disassembly.

Wrench, socket, 1¼-in. — Puller

(1) REMOVE ROLLER. Follow paragraph **b**, above.

(2) REMOVE GUIDE RODS AND SPRINGS.
Wrench, socket, 1¼-in.
Turn clamp screws until compression is removed from springs. Remove clamps, rods, and springs.

(3) REMOVE ROLLER BUSHINGS AND BEARINGS.
Puller
Pull bearings out of bushings by hand and then, using puller, remove bushings.

d. Maintenance and Repairs.

(1) The roller bumper requires little or no maintenance unless it is damaged. The bearings should be kept free and oiled. This should be done during the 1000-mile maintenance service.

FRAME

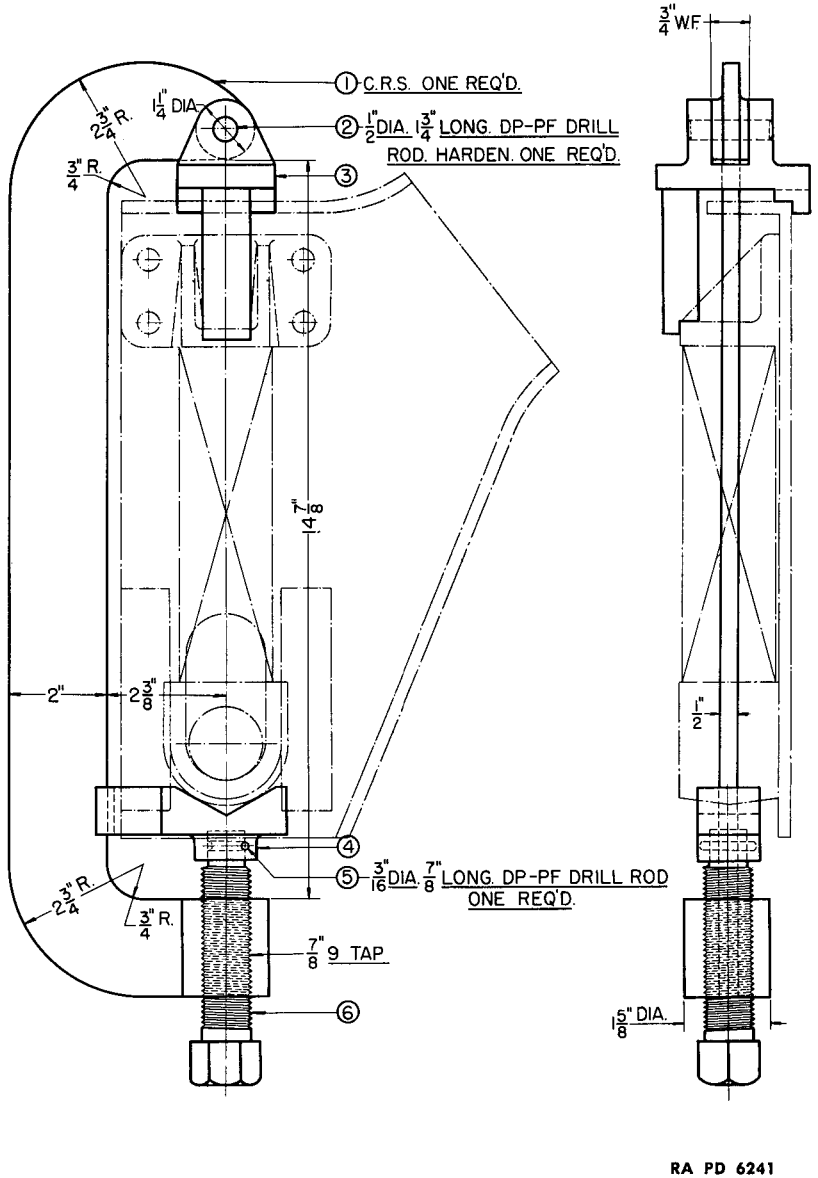


Figure 129—Front Roller Spring Compressing Tool

(2) If the roller is pierced by shell fire, it can be repaired by welding plates over the holes.

(3) When the roller is damaged beyond repair, it should be removed, as explained in paragraph c above, and replaced with a new roller.

(4) If the roller is disassembled for any reason, check the compression springs for breaks or permanent set; if apparent, replace with new springs. Check the bearings also, and if badly worn or damaged, replace.

e. Reassembly.

Hammer — Tool, bushing driving

(1) REPLACE BUSHINGS.

Hammer — Tool, bushing driving

Drive bushings into roller end tubes.

(2) REPLACE BEARINGS. Push bearings into bushings by hand.

f. Installation of Assembly.

Block, wooden — Hammer
Clamps, special, two — Wrench, socket, 1¼-in.

(1) CLAMP SPRINGS AND GUIDE RODS IN POSITION.

Clamps, special, two — Wrench, socket, 1¼-in.

Attach clamp to top of roller support. Place compression spring on guide rod, and set rod into clamp in line with spring stop bracket hole. Turn clamp screw and compress spring until shaft hole in guide rod lines up with slotted hole in roller support. Follow this procedure for second rod and spring.

(2) REPLACE ROLLER ASSEMBLY.

Block, wooden — Hammer

Lift roller into place, making sure that square shoulders of bearings slide into guide slides and bearing holes line-up with guide rod shaft holes. Push one end of shaft through guide rod, making sure that tapered pin hole in shaft lines up with pin hole in rod. Holding wooden block against opposite end of shaft, drive shaft through bearings and opposite guide rod.

(3) REPLACE TAPERED PINS.

Hammer

Drive pins through guide rods and shaft. Remove clamps.

44. BUMPERS.

a. Front Bumperettes (fig. 128). Two bumperettes made of channel steel are provided for the front end of the vehicle and are located to

the left and right of the front bumper roller. Each bumperette is riveted to the frame rail and stiffened with gussets at the corners. The upper gussets are riveted to both the bumperettes and frame rails. The lower gussets are riveted to the bumperettes and bolted to the frame rails. No maintenance is required unless the bumperettes are badly damaged, at which time they should be replaced or straightened and new gusset plates substituted.

b. Rear Bumpers. Two rear bumpers consisting of pieces of channel steel are bolted to the lower left- and right-hand side at the rear of the body or body bracket. They are bolted with their flat surface against the body or body bracket and are treated as part of the body. No maintenance is required.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section X

FUEL SYSTEM

	Paragraph
Description	45
Trouble shooting	46
Fuel tanks	47
Fuel lines	48
Fuel pump, carburetor and air cleaner	49

45. DESCRIPTION (fig. 130).

The air fuel system consists of two main fuel tanks, fuel lines, a transfer and shutoff valve, fuel and vacuum pump, fuel filter, carburetor, air cleaner, throttle control, and engine intake manifold. The fuel tanks are located within the body for protection, and each is connected to the transfer and shut-off valve by a steel pipe assembly. The shut-off valve is located behind the driver's seat and is in turn connected to the intake side of the fuel and vacuum pump by a single steel pipe assembly with flexible hose assemblies at each end. The fuel and vacuum pump is bolted to the lower left side of the engine crankcase. The carburetor is mounted on and connected to the engine intake manifold at the upper right-hand side of the engine and has a fuel filter attached to its inlet fitting. The fuel filter is connected to the outlet side of the fuel and vacuum pump by a pipe assembly which passes over the top of the engine. The air cleaner is bolted to the right hand, engine side of the dash, and is connected to the air intake of the carburetor by a rubber hose and horn assembly.

a. Operation. Fuel flows from the tanks to the transfer and shut-off valve by gravity. At this point, either tank can be selected to feed the system by simply opening or closing the individual shut-off cocks. The fuel continues from the shut-off valve to the inlet side of the fuel pump and is then drawn into the pump chamber by vacuum. The pump forces the fuel up through the fuel filter and into the carburetor. The engine intake manifold draws air from the air cleaner down through the air intake of the carburetor. The air is mixed with the fuel in the carburetor, and the mixture continues on through the manifold to the engine cylinders.

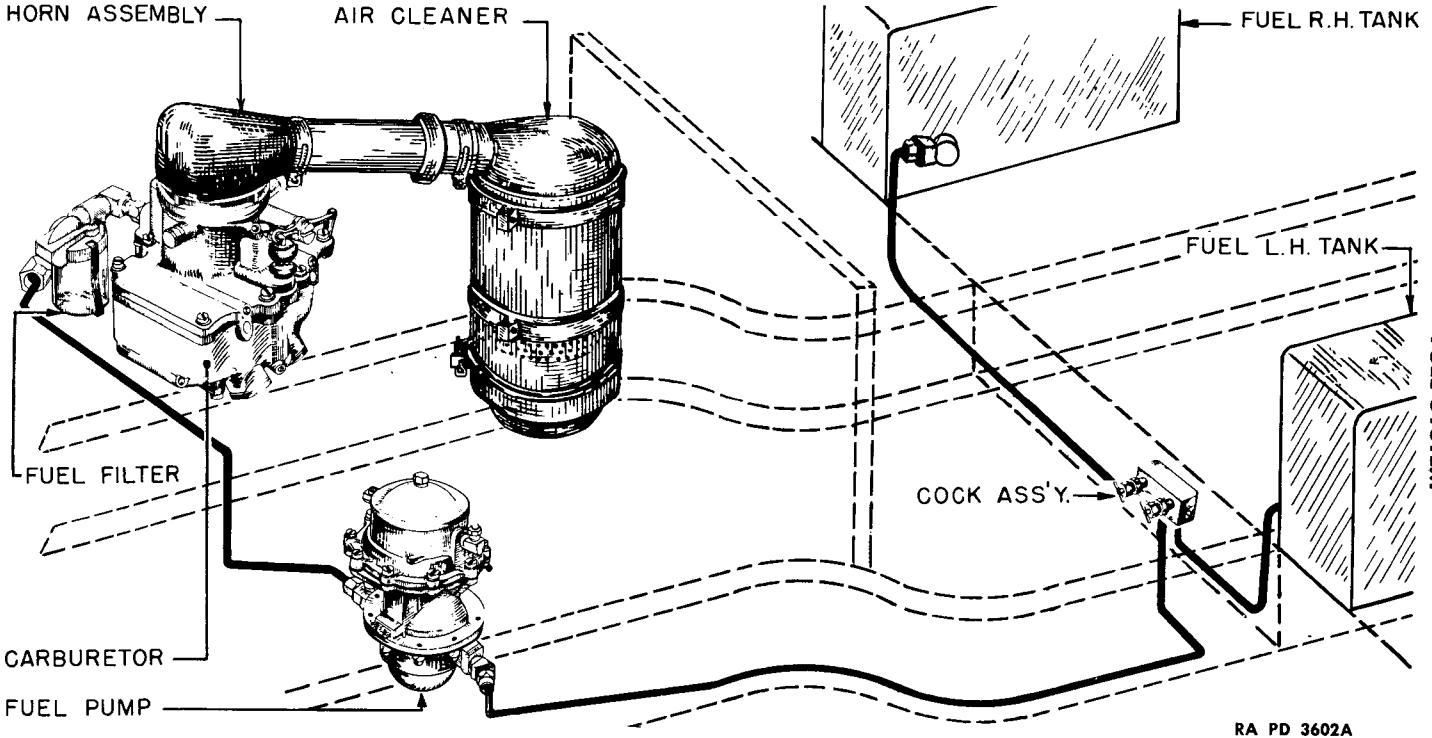


Figure 130—Vehicle Fuel System—Schematic

b. Specifications.

Fuel tanks
- Make . . . Mitchel Metal Co. and Goodyear Rubber Co.
- Type Bullet sealing
- Location Within body
- Capacity 30 gal each

Fuel and vacuum pump
- Make A.C.
- Model 1537524
- Type Mechanical

Fuel filter
- Make Zenith
- Model F291X2
- Type Metallic element

Carburetor
- Make Stromberg
- Model AAV-2
- Size 1¼ in.
- Venturi size 1⅛ in.

Air cleaner
- Make Donaldson
- Model E787
- Type Oil bath

46. TROUBLE SHOOTING.

Symptom and probable cause	Probable remedy
a. Excessive fuel consumption.	
Poor carburetor adjustment.	Adjust idling needle valve. Adjust throttle stop screw. Adjust float level.
Dirty air cleaner.	Clean and renew oil bath.
Fuel leaks.	Check carburetor, fuel pump, fuel tanks, and all lines and connections.
Excessive idling.	Stop engine during long waits.
Excessive engine temperature.	See Cooling System, Section VII.
Brakes dragging.	See Brake Systems, Section VI.
Tires under-inflated.	Inflate to recommended pressure.
Vehicle overloaded.	Load only to rated capacity of vehicles.
b. Fast idling.	
Rich fuel mixture.	Adjust idling needle valve.
Carburetor controls sticking.	Free controls.
Improper control adjustment.	Inspect choke valve for full opening.

Symptom and probable cause	Probable remedy
c. Low fuel pressure.	
Fuel pump diaphragm not operating properly.	Tighten holding screws or replace diaphragm.
Air leaks.	Tighten all fuel line connections.
	Check fuel filter glass bowl connection.

NOTE: For more detailed trouble shooting information on fuel system, carburetor, fuel pump, fuel filter, and air cleaner, see TM 9-1711.

47. FUEL TANKS.

a. Description (fig. 131). Two tanks of thirty gallons capacity each are provided for each vehicle and are located within the body.

(1) CONSTRUCTION (fig. 132). The two fuel tanks are constructed of sheet steel and have a bullet sealing covering. Located at the top center of the tank is the filler cap, which includes a combined pressure relief and a venting valve. Inserted into the filler cap spout is a cylindrical fitting screen. Also located on the front top of the tank is the electrically operated fuel tank gage consisting of a float mechanism and rheostat. A circular flange drilled for five screws fastens it to the tank. At the front end about one-half inch from the bottom of the tank is the outlet elbow for the fuel line fitting. On the bottom of the tank extending through the bullet sealing covering is the drain plug. The tank is held in place by means of a cover plate screwed to the body side and floor plates.

(2) OPERATION. The combined pressure relief and venting valve in the filter cap functions in two ways. When pressure due to fuel expansion builds up in the tank the relief valve will open, relieving pressure. The spring-loaded ball venting valve incorporated in the stem of the pressure valve maintains atmospheric pressure in the tank by admitting air when fuel is being drawn from the tank. The fuel tank gage float moves with the fuel tank level and is geared to a shaft that operates the arm on the rheostat, which controls the flow of current operating the dash fuel gage. Fuel is drained from the tank by removing the drain plug located in the bottom of the tank.

(3) SPECIFICATIONS.

Make . . . Mitchel Metal and Goodyear
Type Bullet sealing
Ordnance No.
L. H. E3807
R. H. E3808
White No.
L. H. 376270
R. H. 376271
Autocar No.
L. H. 6W6160
R. H. 6W6150
Diamond T No.
L. H. N-23207
R. H. N-23207



Figure 131—Fuel Tank Details

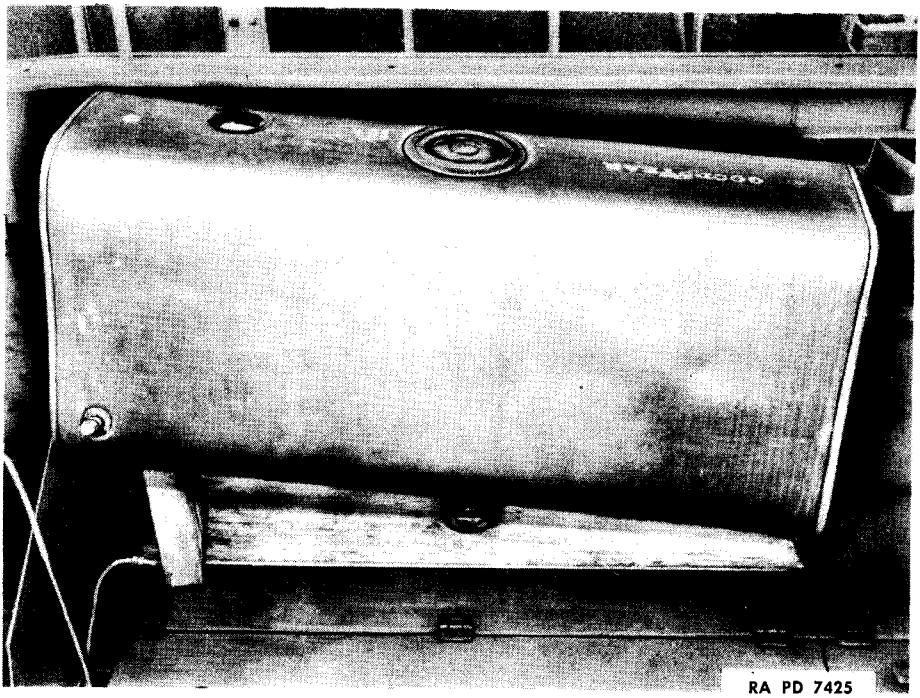


Figure 132—Fuel Tank Removal

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) EXCESSIVE FUEL CONSUMPTION.	
Loose fuel tank outlet fitting.	Tighten fitting.
Leak at outlet fitting threads.	Replace fitting.
Loose fuel tank drain plug.	Tighten plug.
Leak in fuel tank.	Replace tank.
(2) LACK OF FUEL.	
Clogged outlet fitting.	Remove fitting and clean.
Dirt in filler cap vent valve.	Inspect vent valve parts and holes and clean.
Dirt in fuel tank.	Drain tank, filter fuel, and refill tank.
Incorrect or no fuel gage.	Inspect fuel tank gage and repair or replace.
(3) TANK FILLS SLOWLY.	
Dirty filler spout filter screen.	Wash screen in SOLVENT, dry-cleaning, and clean thoroughly.

c. Removal of Assembly.

Screwdriver
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{1}{2}$-in.
Wrench, open-end, $\frac{11}{32}$-in.

(1) REMOVE FUEL TANK COVER PLATE.

Screwdriver
Wrench, open-end, $\frac{9}{16}$-in.

Loosen and remove seven machine screws and nuts from tank cover, and lift off cover.

(2) REMOVE FUEL LINE SHIELD.

Wrench, open-end, $\frac{7}{16}$-in.

Remove two bolts, nuts and lock washers, and remove shield.

(3) DISCONNECT FUEL LINE CONNECTION.

Wrench, open-end, $\frac{1}{2}$-in.

Disconnect fuel line flared tube nut at tank.

(4) DISCONNECT TANK FUEL GAGE WIRE.

Wrench, open-end, $\frac{11}{32}$-in.

Loosen fuel tank gage terminal nut and remove wire.

(5) REMOVE TANK.

Lift out tank.

d. Disassembly of Components.

(1) TANK.

Pliers
Wrench, adjustable
Screwdriver

(a) Filler cap.

Unscrew cap assembly and remove from tank.

(b) Remove tank fuel gage unit.

Screwdriver

Remove five attaching screws from tank fuel gage flange, and remove gage assembly and gasket (fig. 133).

(c) Remove fuel tank outlet elbow and drain plug.

Wrench, adjustable

Remove outlet elbow and drain plug from tank.

(2) FILLER CAP.

(a) Disassemble cap.

Pliers

Pull cotter pin from stem of pressure valve, and slide off washer and spring. Turn valve stem down, and vent valve washer, spring, and ball vacuum valve will drop out of stem (fig. 134).

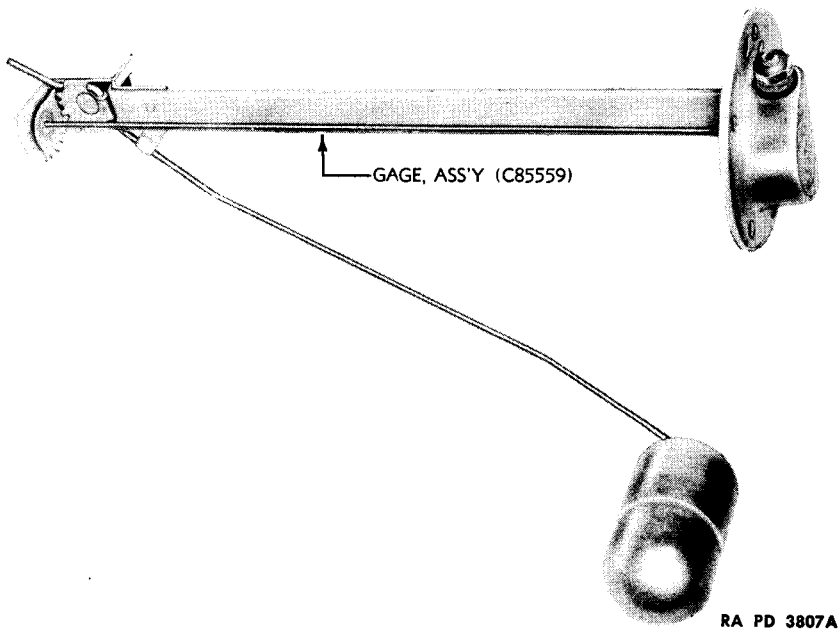


Figure 133—Tank Unit Fuel Gage with Float Assembly

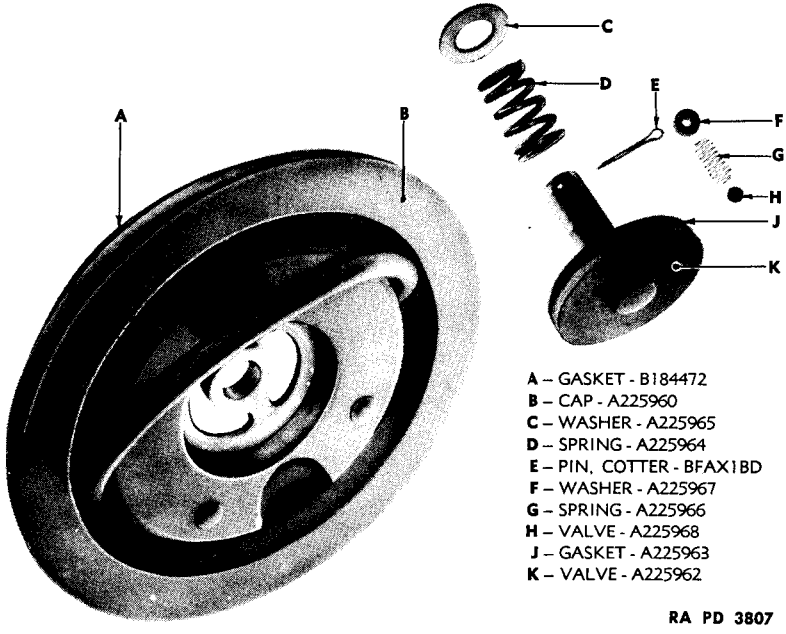


Figure 134—Fuel Tank Filler Cap—Exploded

e. Maintenance and Adjustment.

With the bullet sealing covering, fuel tanks give little or no trouble and require no servicing other than an occasional cleaning.

(1) Inspect drain plug and fuel line fittings for leaks.

(2) The filler cap combined pressure and vent valves should be examined to see if they are operating freely and the vent hole is cleaned of dirt. The cap should be replaced immediately after filling tank to prevent dirt from entering.

(3) The filler spout screen should be removed and cleaned of any sediment.

(4) Remove tank fuel gage unit and inspect float; if a leak has developed, it should be soldered after all traces of fuel and fuel vapors have been removed. If for any other reason the gage is inoperative, the unit should be replaced.

f. Reassembly.

(1) FILLER CAP.

(a) Reassemble filler cap, pressure relief and venting valve.

Pliers

Insert ball valve, spring, and washer into valve stem. Place valve on its seat in filler cap. Slide spring and washer on valve stem and insert and spread cotter pin.

(2) FUEL TANK.

(a) Replace outlet fitting and drain plug.

Wrench, adjustable

Screw fitting and plug into tank and tighten.

(b) Replace fuel gage unit.

Screwdriver

Set gasket in place around tank opening, and install gage unit. Replace screws through flange, and tighten assembly.

(c) Replace filler cap assembly.

Screw cap into tank opening.

g. Installation of Assembly.

Screwdriver
Wrench, box, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{7}{16}$-in.
Wrench, open-end, ½-in.
Wrench, open-end, $1\frac{1}{2}$-in.

(1) REPLACE FUEL TANK.

Set tank in position in body.

(2) CONNECT FUEL TANK GAGE WIRE.

Wrench, open-end, $1\frac{1}{2}$-in.

Hook wire over terminal, and tighten terminal nut.

(3) CONNECT FUEL LINE TO TANK.
Wrench, open-end, ½-in.
Tighten fuel line flared tube nut onto tank outlet fitting.

(4) REPLACE FUEL LINE SHIELD.
Wrench, open-end, $\frac{7}{16}$-in.
Set shield in position and fasten with bolts, lock washers, and nuts.

(5) REPLACE FUEL TANK COVER PLATE.
Screwdriver
Wrench, box, $\frac{9}{16}$-in.
Set plate in position and fasten it to body by replacing screws and nuts.

48. FUEL LINES.

a. Description. The fuel lines connect the fuel tanks to the three-way shut-off valve located behind the driver's seat (figs. 135 and 136). A single line with flexible base assemblies at each end connects the shut-off valve outlet to the fuel pump inlet.

b. Construction. The lines connecting the tanks to the shut-off valve are steel tubes which are covered with a protective loom. The ends of the tubes are flared to take flared tube nuts. The bronze shut-off valve has two threaded inlets and a single outlet. Each inlet has a shut-off cock so that either tank can be used when needed. The flared end steel tube which feeds the carburetor is connected to the shut-off valve outlet at one end and the carburetor at the other by flexible hose assemblies.

c. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) LEAKING LINES.	
Split tube.	Loose fitting.
Replace line assembly.	Tighten or replace, if necessary.
(2) FUEL FEEDING SLOWLY OR NOT AT ALL.	
Dirt in lines.	Remove lines and clean.

d. Removal.

Wrench, open-end, ½-in.
Wrench, open-end, $\frac{11}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{13}{16}$-in.

(1) REMOVE FLEXIBLE HOSE ASSEMBLY BETWEEN FUEL PUMP AND SHUT-OFF COCK LINE.
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Disconnect nuts at fuel pump inlet fitting and shut-off cock line, and remove flexible hose.

(2) REMOVE LINE ASSEMBLY (SHUT-OFF COCK TO FLEXIBLE HOSE).
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Disconnect flared tube nuts at shut-off cock and flexible hose, and remove line.

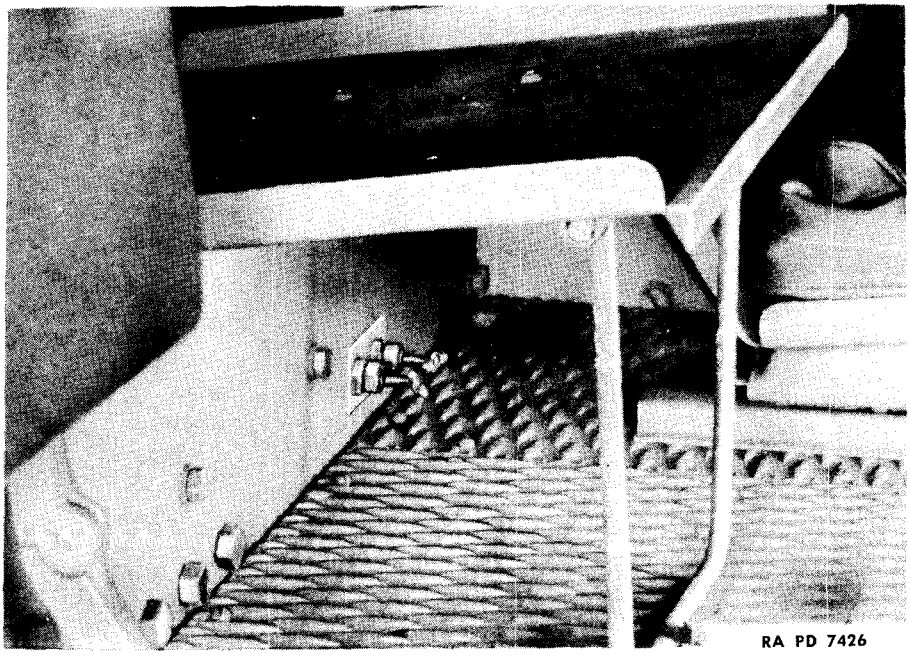


Figure 135—Three-Way Shut-Off Valve—Installed, Front View

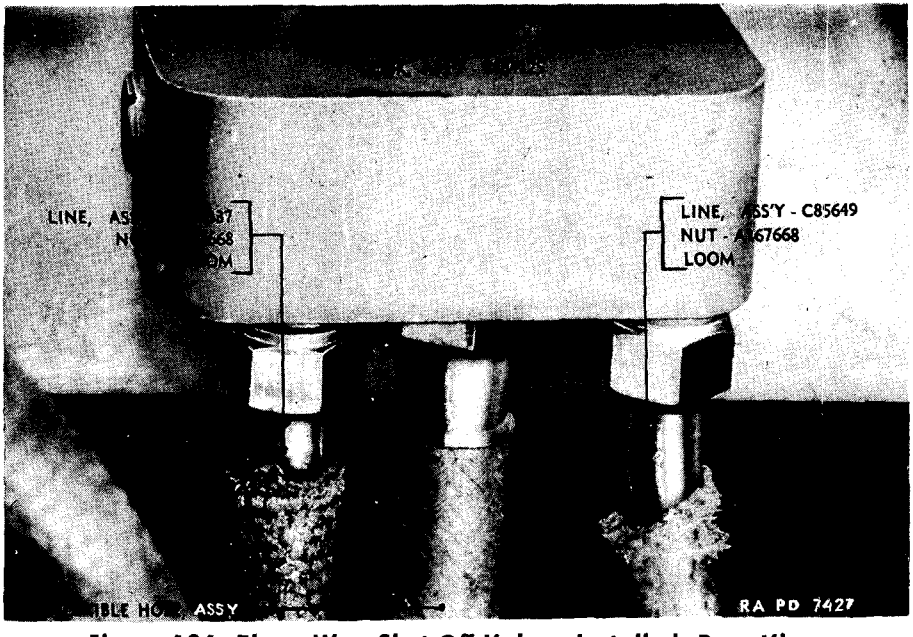


Figure 136—Three-Way Shut-Off Valve—Installed, Rear View

(3) REMOVE LINE ASSEMBLY (SHUT-OFF COCK TO LEFT-HAND TANK UNION).

Wrench, open-end, ½-in. Wrench, open-end, $\frac{9}{16}$-in.

Disconnect two flared tube nuts at shut-off cock and union, and remove line.

(4) REMOVE LINE ASSEMBLY (SHUT-OFF COCK TO RIGHT-HAND TANK UNION).

Wrench, open-end, ½-in. Wrench, open-end, $\frac{9}{16}$-in.

Disconnect two flared tube nuts at shut-off cock and union, and remove line.

(5) REMOVE LINE ASSEMBLY (LEFT-HAND TANK TO UNION).

Wrench, open-end, ½-in. Wrench, open-end, $\frac{9}{16}$-in.

Disconnect flared tube nut at union, and remove union. Disconnect flared tube nut at tank outlet fitting, and remove line.

(6) REMOVE THREE-WAY SHUT-OFF COCK ASSEMBLY.

Wrench, open-end, $1\frac{1}{16}$-in. Wrench, open-end, $1\frac{3}{16}$-in.

Unscrew shut-off cock packing nuts, and remove cocks and packings. Then remove cock assembly holding nuts and lift off valve.

e. Maintenance and Adjustments.

(1) Lines and fittings should be inspected for leaks, breaks, and worn spots. Check and tighten all fittings and flared tube nuts. If the line still continues to leak, replace with new assembly.

(2) If standard line sections are not available for replacements, lines can be made from stock as follows:

(a) Cut tubing to length required, and remove burs and dirt from tubing.

(b) Cut protector loom to length, and slide onto tubing.

(c) Place flared tube nut on each end of tubing, and flare ends of tubing using a flaring tool. See section VI, paragraph 26 **d** (1), above.

f. Installation.

Wrench, open-end, ½-in. Wrench, open-end, $1\frac{1}{16}$-in.
Wrench, open-end, $\frac{9}{16}$-in. Wrench, open-end, $1\frac{3}{16}$-in.

(1) REPLACE SHUT-OFF COCK ASSEMBLY.

Wrench, open-end, $1\frac{1}{16}$-in. Wrench, open-end, $1\frac{3}{16}$-in.

Fasten valve to car body by replacing holding nuts. Then replace shut-off cocks and packings, and tighten packing nuts.

(2) REPLACE LINE ASSEMBLIES (RIGHT- AND LEFT-HAND TANKS TO UNIONS).

Wrench, open-end, ½-in. Wrench, open-end, $\frac{9}{16}$-in.

Hold each line in position, and connect one end to fuel tank outlet

fitting with flared tube nut. Then screw union into flared tube nut at opposite end of line assembly.

(3) REPLACE LINE ASSEMBLIES (RIGHT- AND LEFT-HAND UNION TO SHUT-OFF VALVE).

Wrench, open-end, ½-in. Wrench, open-end, $\frac{9}{16}$-in.

Hold each line in position and connect to valve and union with flared tube nuts at each end of line.

(4) REPLACE FLEXIBLE HOSES AND LINE ASSEMBLY (SHUT-OFF VALVE TO FUEL PUMP).

Wrench, open-end, ½-in. Wrench, open-end, $\frac{9}{16}$-in.

Attach one flexible hose assembly to fuel pump inlet fitting and the other to shut-off valve outlet. Then hold line assembly in position, and connect it to flexible hoses.

49. FUEL PUMP, CARBURETOR, AND AIR CLEANER.

For complete maintenance information on these units, see TM 9-1711.

Section XI

INSTRUMENTS AND GAGES

	Paragraph
Introduction	50
Instrument cluster	51
Voltmeter	52
Speedometer	53
Tachometer	54

50. INTRODUCTION.

The instruments mounted on the instrument panel consist of a four-unit instrument cluster, a voltmeter, a speedometer, and a tachometer, (fig. 137). The indirectly lighted four-unit cluster assembly is mounted in a case at the left center of the panel and is composed of an ammeter, temperature gage, fuel gage, and the oil pressure gage. Located at the right center of the panel is the voltmeter. The speedometer is mounted approximately in the center of the panel, just to the right of the cluster assembly. Attached to the back of the speedometer case is a bracket which holds the socket and lamp for the indirect lighting of both the speedometer and cluster assembly. The tachometer is mounted at the extreme left side of the panel and has a bracket attached to its case for holding the socket and bulb which indirectly lights the instrument.

NOTE: In later production vehicles, a compass is being mounted on the center of the windshield frame.

51. INSTRUMENT CLUSTER.

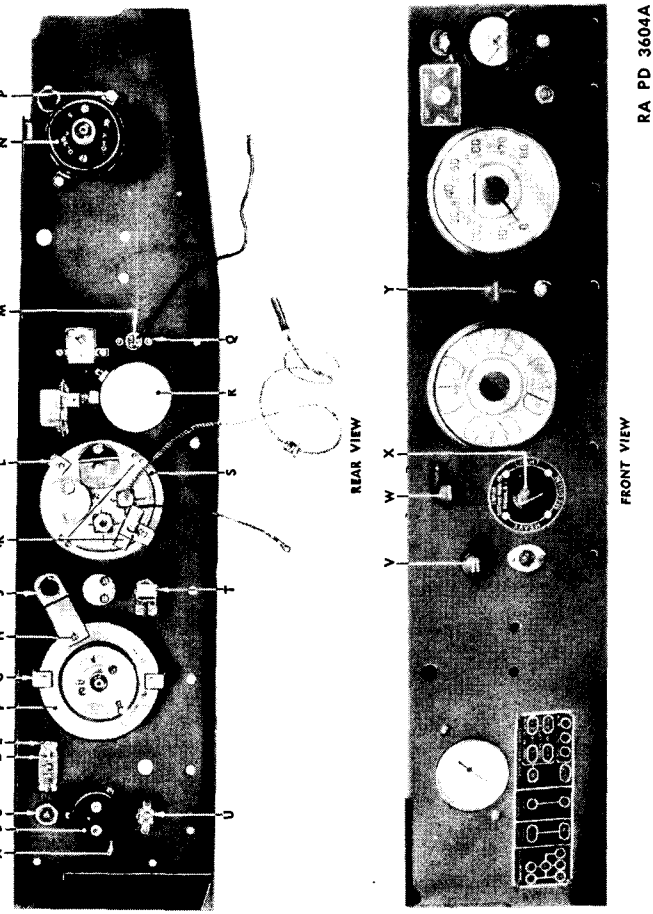
a. Description (figs. 138 and 139). The instruments of the cluster assembly are grouped in a circular case, with the ammeter at the top and the temperature gage at the bottom. At the right is the oil gage and at the left is the fuel gage.

(1) CONSTRUCTION.

(a) The instruments of the cluster assembly are mounted on two semicircular plates which are attached to the case by four machine screws, two in each plate. Mounted on one plate are the oil and temperature gages, and on the other plate are the fuel gage and the ammeter. Two brackets with nuts, studs, and lock washer attach the case to the instrument panel.

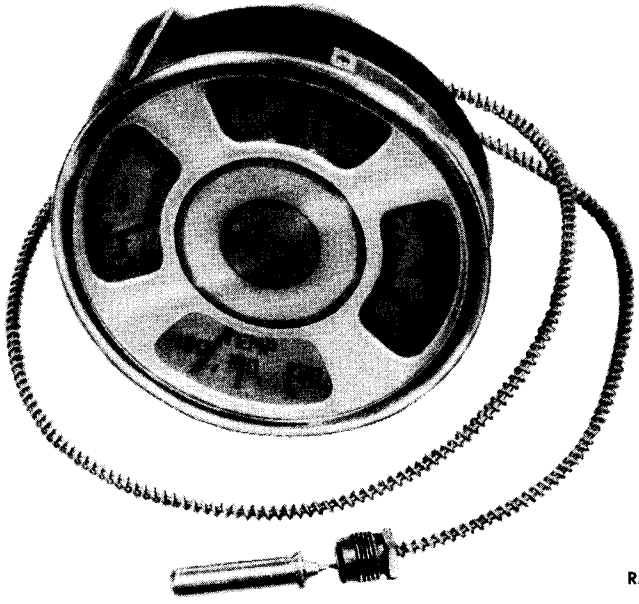
(b) The ammeter, used in conjunction with a shunt, is of the magnetic type, with a permanent magnet operating the pointer. The dial is graduated to read (+) 100 — 0 — (−) 100 amperes. Two insulated terminal posts connect the generator and battery wires to the instrument. Two screws fasten the ammeter to the cluster case mounting plate.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES



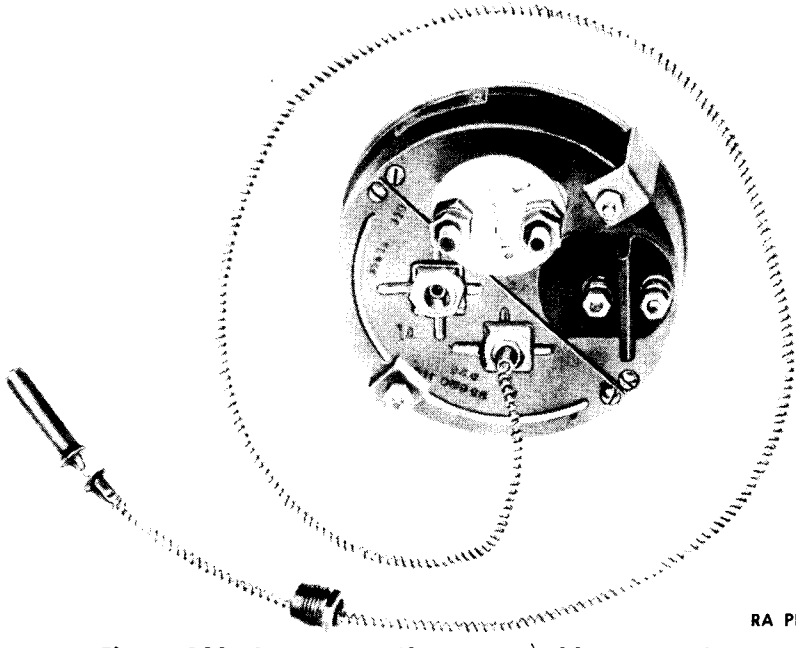
A — SCREW, PARKER, KALON-TYPE "Z", 3/4" LONG, NO. 4
NUT-SPEED - NO. 106-1 - TINNERMAN
B — VOLTMETER - A190863
C — LIGHT, VOLTMETER - A214460
D — SWITCH - A167674
E — SCREW - BCNXIFD
NUT - BBKX2B
WASHER, LOCK - BECX1D
F — SPEEDOMETER, ASS'Y - C85583
BULB - A186607
G — BRACKET - SW-74074
NUT - BBMX1C
WASHER, LOCK - BECX1E
H — SCREW - BCNX1FB
WASHER - BEAX1E
J — BRACKET - SW-74124
K — CONDENSER W/LEAD, ASS'Y - A214381
L — BRACKET - SW-74074
NUT - BBMX1C
WASHER, LOCK - BECX1E
M — RECEPTACLE - A214438
N — TACHOMETER, ASS'Y - C85515
BULB - A226062
P — SCREW - A226058
NUT - BBKX2C
SPACER - A214908
Q — SCREW - A226056
NUT - A226055
WASHER, LOCK - BECX1D
R — RHEOSTAT, ASS'Y - A225090
S — CLUSTER, ASS'Y - C85570
T — SWITCH - B184176
U — SWITCH - A214460
V — RHEOSTAT - B184202
W — SWITCH - C85774
X — KNOB, RHEOSTAT - A214532
Y — SWITCH, IGNITION - B184147

Figure 137—Instrument Panel and Instruments



RA PD 6217

Figure 138—Instrument Cluster Assembly—Front View



RA PD 6216

Figure 139—Instrument Cluster Assembly—Rear View

(c) The electrically operated fuel gage is of the balanced coil type with a pointer and dial graduated to indicate "Empty — ¼ — ½ — ¾ — Full". The gage has two insulated terminal posts, one for the wire from the fuel tank gage unit, the other for the wire going to the ignition switch. The two terminal posts are also utilized for attaching the instrument to the cluster case mounting plate.

(d) The oil gage consists of a Bourdon tube which operates the pointer. An adapter for the oil line flared tube fitting is soldered to the Bourdon tube. The dial for reading the pressure is graduated from 0 — 40 — 80 pounds. The instrument is attached to the cluster case mounting plate by means of a nut.

(e) The temperature gage consists of a Bourdon tube operating the pointer. The dial is graduated for 100 F — 180 F. A liquid-filled vapor bulb, with an adapter nut, and a length of tubing, one end of which is soldered to the Bourdon tube, the other to the vapor bulb, is attached to the engine cylinder head. The instrument is attached to the cluster case mounting plate by means of a nut.

(2) OPERATION.

(a) The ammeter indicates total current discharge (—) under any load, with the generator inoperative and the net charge (+) to the battery when generator is operating, regardless of auxiliary loads. The ammeter does not indicate total generator output, although it can be utilized to do so for test purposes by shifting the generator lead to the battery terminal of the ammeter. The generator begins charging when the vehicle reaches a speed of from 7 to 10 miles per hour and shows a positive (+) reading on the ammeter. The charging rate increases with the vehicle speed until a maximum rate is reached at approximately 25 miles per hour. With a fully charged battery, little or no charging rate will be indicated by the ammeter, because of the action of the generator cut-out relay.

(b) The fuel gage indicates level of fuel in the tank, and is only operative when the ignition switch is turned on. The fuel gage is operated by the fuel tank unit, consisting of a rheostat and a float mechanism. The float element of this unit moves with the fuel tank level and is geared to a shaft which operates the rheostat arm. The rheostat controls the flow of current to the fuel gage coils, moving the gage pointer in relation to the quantity of fuel in the tank. The fuel tank transfer switch permits the reading of either tank from one gage.

(c) Attached to the oil gage Bourdon tube is a pipe which is connected at its opposite end to the delivery or pressure side of the oil pump. As the oil pressure increases, the air in the pipe is compressed, and this pressure expands the Bourdon tube; as the oil pressure decreases the

reverse action occurs and the Bourdon tube contracts. This expansion and contraction of the Bourdon tube actuates the oil gage pointer. Oil pressure reading will vary according to operating conditions. The oil gage does not indicate the amount of oil in the crankcase.

(d) The temperature gage indicates the engine water temperature and is calibrated to be read in Fahrenheit. The normal operating range under average conditions should be between 140 F and 180 F. The Bourdon tube unit of this instrument which actuates the dial pointer is controlled by a low boiling point liquid contained in the vapor bulb. As the engine water temperature rises, the liquid forms a gas creating pressure in the bulb, thereby expanding the Bourdon tube. As the water temperature lowers, the gas pressure is reduced, contracting the Bourdon tube.

(3) SPECIFICATIONS.

Ammeter
- Make Stewart-Warner
- Type Electro-Magnetic
- Mfrs. No. SW-105820
- Ordnance No. A226028
- White No. 373850
- Autocar No. 105820
- Diamond T No. . . G-105820

Fuel gage
- Make Stewart-Warner
- Type Electro-Magnetic
- Mfrs. No. SW-95622
- Ordnance No. A169293
- White No. K95622

Oil gage
- Make Stewart-Warner
- Type Pressure
- Mfrs. No. SW-95614
- Ordnance No. A169292
- White No. K95614
- Autocar No. 95614
- Diamond T No. . . . G-95614

Temperature gage
- Make Stewart-Warner
- Type Fluid Expanding
- Mfrs. No. SW-95620
- Ordnance No. B184389
- White No. 340115
- Diamond T No. . . . G-95620

b. Removal of Assembly.

Wrench, open-end, 3/8-in.
Wrench, open-end, 7/16-in.
Wrench, open-end, 9/16-in.
Wrench, open-end, 5/8-in.

(1) REMOVE INSTRUMENT SHIELDING BOX COVER.
Remove two thumb screws and remove cover.

(2) REMOVE TEMPERATURE GAGE BULB ADAPTER.
Wrench, open-end, 5/8-in.
Loosen temperature gage bulb adapter nut at engine, and remove bulb from adapter.

(3) REMOVE OIL GAGE LINE.
Wrench, open-end, 7/16-in.
Remove oil line nut located on the back of cluster case plate.

(4) REMOVE AMMETER WIRES.
Wrench, open-end, $\frac{9}{16}$-in.
Loosen two ammeter wire terminal nuts, and remove wires.

(5) REMOVE FUEL GAGE WIRES.
Wrench, open-end, 3/8-in.
Loosen two fuel gage wire terminal nuts, and remove wires.

(6) REMOVE CLUSTER ASSEMBLY AND MOUNTING BRACKETS.
Wrench, open-end, 3/8-in.
Remove two cluster assembly mounting stud nuts and lock washers. Then remove two brackets and lift out cluster assembly.

c. Disassembly (fig. 140).

Screwdriver
Wrench, open-end, 1/4-in.
Wrench, open-end, 3/8-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, open-end, $\frac{11}{16}$-in.

(1) REMOVE CLUSTER FROM PANEL.
Refer to paragraph **b**, above.

(2) REMOVE INSTRUMENTS FROM CASE AND BEZEL ASSEMBLY.
Screwdriver
Wrench, open-end, 1/4-in.
Remove two case mounting studs and four backing plate screws, and lift plates with instruments from case.

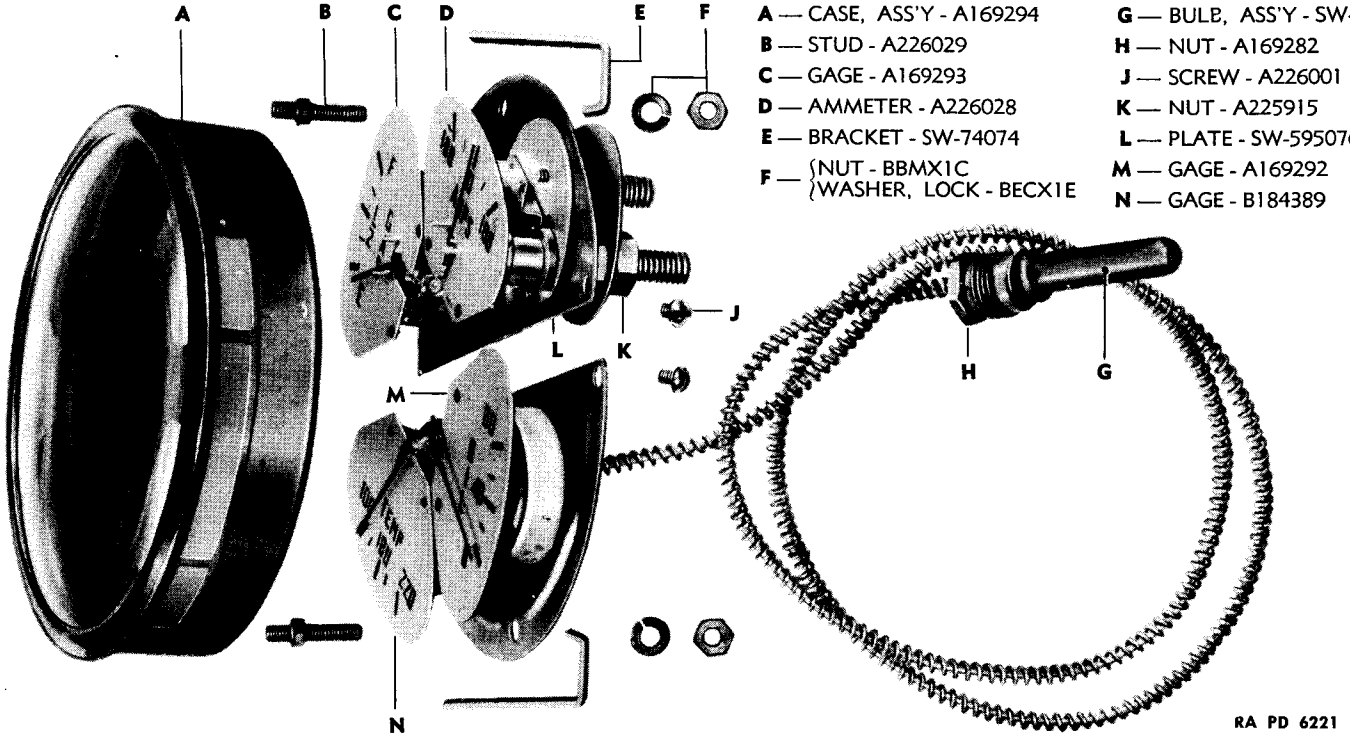
(3) REMOVE OIL GAGE FROM MOUNTING PLATE.
Wrench, open-end, $\frac{11}{16}$-in.
Remove attaching nut, and lift oil gage from plate.
NOTE: Temperature gage is not to be removed from plate.

(4) REMOVE FUEL GAGE FROM MOUNTING PLATE.
Wrench, open-end, 3/8-in.
Remove two terminal stud nuts, two lock washers, and two plain brass washers. Then remove insulator and fuel gage.

(5) REMOVE AMMETER FROM MOUNTING PLATE.
Screwdriver, small
Wrench, open-end, $\frac{9}{16}$-in.
Remove two terminal nuts and insulator. Then remove three screws and lock washers, and lift ammeter from plate.

d. Maintenance and Adjustments.

(1) The ammeter requires no adjustments. If the ammeter does not function after the electrical system has been checked, replace ammeter. Tests may be made to determine current at the ammeter terminal posts with a portable ammeter. If the ammeter pointer fails to show discharge (—) with the lights turned on and the engine not running, it indicates a faulty ammeter.



A — CASE, ASS'Y - A169294
B — STUD - A226029
C — GAGE - A169293
D — AMMETER - A226028
E — BRACKET - SW-74074
F — NUT - BBMX1C; WASHER, LOCK - BECX1E
G — BULB, ASS'Y - SW-95617
H — NUT - A169282
J — SCREW - A226001
K — NUT - A225915
L — PLATE - SW-595076
M — GAGE - A169292
N — GAGE - B184389

Figure 140—Instrument Cluster—Exploded

(2) FUEL GAGE. If the fuel gage does not register after the fuel tank gage unit has been checked and inspection shows current at the fuel gage terminals, replace fuel gage.

(3) TEMPERATURE GAGE. The temperature gage requires no adjustments and, once installed, will only become inoperative by the loss of liquid caused by leaks, at which time the instrument should be replaced. Accuracy of the temperature gage may be checked by submerging the vapor bulb in boiling water.

(4) OIL GAGE. Check oil gage for proper readings. Improper pressure or no pressure indicated by the oil gage may be due to the oil pump or an oil line leakage or stoppage. If the oil gage does not indicate proper oil pressure after the engine oiling system has been inspected and found in order, the oil gage should be replaced.

e. Reassembly.

Screwdriver
Wrench, open-end, 1/4-in.
Wrench, open-end, 3/8-in.
Wrench, open-end, 9/16-in.
Wrench, open-end, 11/16-in.

(1) REPLACE AMMETER ON MOUNTING PLATE.

Screwdriver
Wrench, open-end, 9/16-in.

Insert ammeter terminal studs in plate holes, and replace screws attaching ammeter to plate. Slide insulator on terminal studs, and screw on terminal nuts.

(2) REPLACE FUEL GAGE TO MOUNTING PLATE.

Wrench, open-end, 3/8-in.

Insert mounting terminal studs in plate holes, and replace insulator brass washer, lock washer, and nuts.

(3) OIL GAGE.

Wrench, open-end, 11/16-in.

Insert oil gage mounting fitting in plate hole, and replace nut.

(4) REPLACE INSTRUMENTS IN CASE AND BEZEL ASSEMBLY.

Screwdriver
Wrench, open-end, 1/4-in.

Place the two instruments mounting plates in position in case and replace holding studs and screws.

f. Installation of Assembly.

Wrench, open-end, 3/8-in.
Wrench, open-end, 7/16-in.
Wrench, open-end, 9/16-in.
Wrench, open-end, 5/8-in.

(1) INSTALL CLUSTER ASSEMBLY ON INSTRUMENT PANEL.

Wrench, open-end, 3/8-in.

Place cluster assembly in hole on panel. Replace brackets, nuts, and lock washers.

(2) ATTACH TEMPERATURE VAPOR BULB TO ENGINE.

Wrench, open-end, 5/8-in.

Insert bulb in adapter. Screw bulb adapter nut into opening at engine.

(3) CONNECT OIL LINE TO GAGE.

Wrench, open-end, 7/16-in.

Place oil line in fitting, and tighten inverted flared tube nut.

(4) CONNECT FUEL GAGE WIRES.

Wrench, open-end, 3/8-in.

Connect wires to terminal posts, and tighten nuts.

(5) CONNECT AMMETER WIRES.

Wrench, open-end, 9/16-in.

Place wires on terminal posts and replace washers and nuts.

52. VOLTMETER.

a. Description (fig. 141). The direct-current voltmeter is an electromagnetic type with a range of 0 to 20 volts.

(1) CONSTRUCTION. The direct-current voltmeter consists of a magnet, coil, pointer, and dial, which is graduated from 0 to 20 volts. The voltmeter is mounted in a flanged case, and the flange is drilled for three screws which attach it to the instrument panel.

(2) OPERATION. The voltage developed by the battery is measured by the voltmeter. A small amount of current passing through a high resistance coil pivoted on the pointer axis creates a magnetic field whose torque reaction operates the pointer. The voltmeter may be connected or disconnected from the system by the push button switch located on the panel under the voltmeter. Once the generator is operating, checks of system voltage reflect the results of the potential generator output rather than that of the battery. The voltmeter does not substitute for battery hydrometer readings in determining the state of the battery's charge.

(3) SPECIFICATIONS.

Make Hickok-Electric	Ordnance No. A214447
Type Electric	White No. 380153
Manufacturer's No.	Autocar No. 16W22665
Early production vehicles HK-5610-1	Diamond T No. N4599
Later production vehicles B184551	

A — MAGNET - HK-5601-2
B — POINTER STOP - HK-10165
C — {SCREW - HK-B4E
{WASHER - HK-5639-N6
D — MOVEMENT, ASS'Y - HK-5684-1
E — FRAME, ASS'Y - HK-4685-22A
F — {SCREW - HK-B49C
{WASHER, LOCK - HK-#6 (10528-6)
{SPACER - HK-91T7

G — {SCREW - HK-BX15Y
{WASHER, LOCK - HK-#3 (10528-3)
H — SCREW - HK-BA86-1A
J — CASE, ASS'Y - HK-5665-3
K — SCREW, POINTER ADJUSTING - HK-5609
L — DIAL - HK-5607
M — POINTER - HK-5611
N — VOLTMETER, ASS'Y - A190862

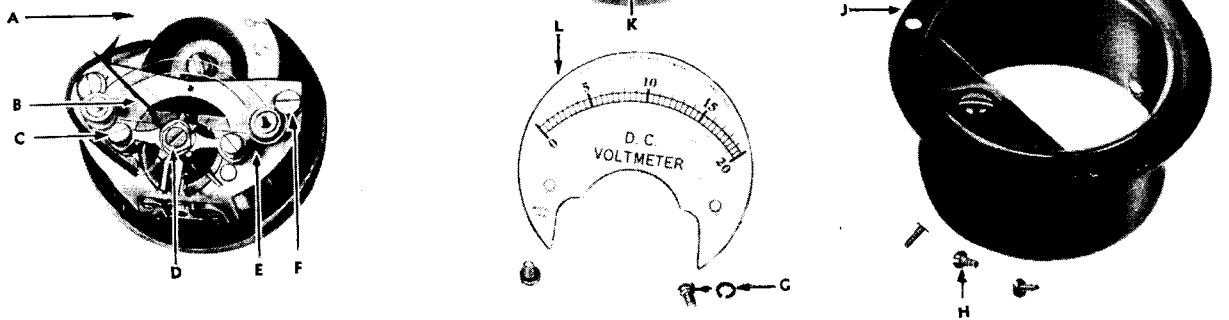


Figure 141—Voltmeter—Exploded

b. Removal of Assembly.

Screwdriver
Wrench, open-end, 3/8-in.

(1) REMOVE VOLTMETER WIRES.

Wrench, open-end, 3/8-in.

Loosen two wire terminal nuts, and pull out wire.

(2) REMOVE VOLTMETER MOUNTING SCREWS AND NUTS.

Screwdriver

Loosen and remove three sheet metal binder screws (Parker Kalon type Y) and three speed nuts (Tinnerman, 106-1). Remove voltmeter.

c. Disassembly of Components (fig. 141).

Screwdriver, small

(1) REMOVE VOLTMETER FROM INSTRUMENT PANEL.

Refer to paragraph **b**, above.

(2) REMOVE VOLTMETER MECHANISM.

Screwdriver, small

Remove three screws that attach case to voltmeter base, and separate mechanism from case assembly.

(3) REMOVE DIAL AND POINTER STOP.

Screwdriver, small

Remove two screws from dial, and take off dial and pointer stop.

d. Maintenance and Adjustments.

(1) If the voltmeter fails to give voltage readings after the push button switch and the electrical system have been inspected, replace voltmeter. To replace broken dial glass, replace with case and glass assembly.

(2) VOLTMETER ADJUSTMENTS. To set voltmeter pointer to zero, turn adjusting screw on face of instrument case until pointer is in line with the zero mark on the dial.

e. Reassembly of Components.

Screwdriver

(1) REPLACE VOLTMETER DIAL AND POINTER.

Screwdriver

Slide dial under pointer so that the two screw holes are in line. Insert screws and tighten.

(2) REPLACE VOLTMETER MECHANISM IN CASE.

Insert voltmeter mechanism in case so that the pointer adjustment screw arm on the face of the case meshes in the adjusting fork on the instrument. Put in three screws attaching case to base of mechanism. Insert and tighten.

f. Installation of Assembly.

Screwdriver
Wrench, open-end, 3/8-in.

(1) INSTALL VOLTMETER ON INSTRUMENT PANEL.

Screwdriver

Place voltmeter in hole on instrument panel, lining up the three screw holes with the holes in panel. Replace screws and nuts, and tighten.

(2) CONNECT VOLTMETER TO SYSTEM.

Wrench, open-end, 3/8-in.

Connect voltmeter wires to terminals, and tighten terminal nuts.

53. SPEEDOMETER.

a. Description (figs. 142 and 143). The speedometer is of the centrifugal magnetic-type with a dial reading from 0 to 80 miles per hour and an odometer unit for season and trip mileage.

(1) CONSTRUCTION. The magnetic-type speedometer, mounted in a case, has a pointer and dial graduated to indicate 0 to 80 miles per hour. The odometer unit of this instrument indicates total mileage (up to 99999.9) and the trip mileage 0 to 999.9 miles. Extending at the rear of the case is a boss, which contains the bearing and drive shaft, and the stem for resetting the trip mileage unit. The boss is internally threaded to take the flexible drive shaft fitting. Two studs are attached to the back of the case to mount the speedometer to the instrument panel.

(2) OPERATION.

(a) The speedometer is actuated by a positive driven revolving magnet exerting a drag on a circular metal speed cup which acts as a field. The speedometer pointer is attached to the field cup shaft. The field cup revolves in relation to the speed of the magnet, which is driven by a flexible shaft through a pair of gears located in the transfer case.

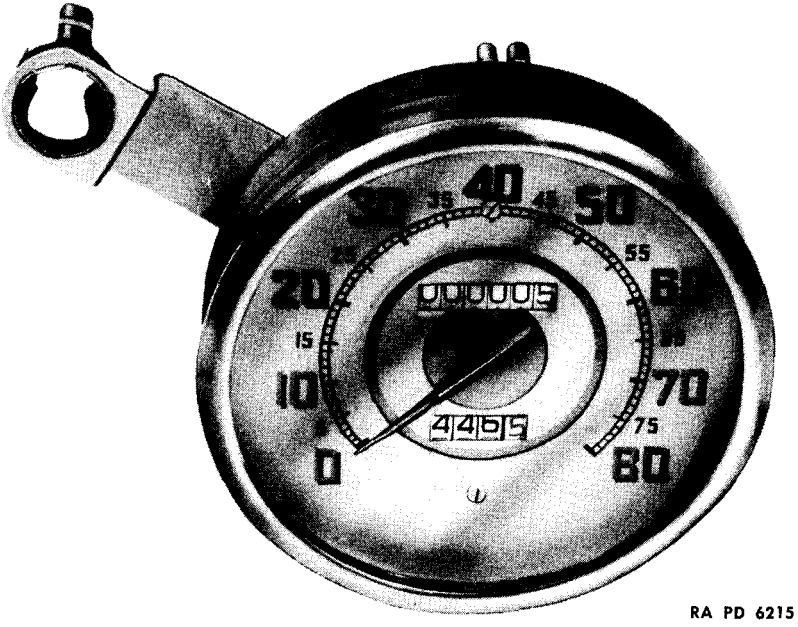
(b) The season odometer unit is positive driven, through a series of worms and worm-gears, by the flexible shaft. The trip odometer shaft is driven from the season odometer by a pair of spare gears. The trip odometer is reset by pushing in the reset stem and turning it clockwise.

(3) SPECIFICATIONS.

Make Stewart-Warner	Ordnance No. C85583
Type Centrifugal	White No. 363756
Manufacturer's No. SW-585-AM	Autocar No. 16W4760
	Diamond T No. N1599

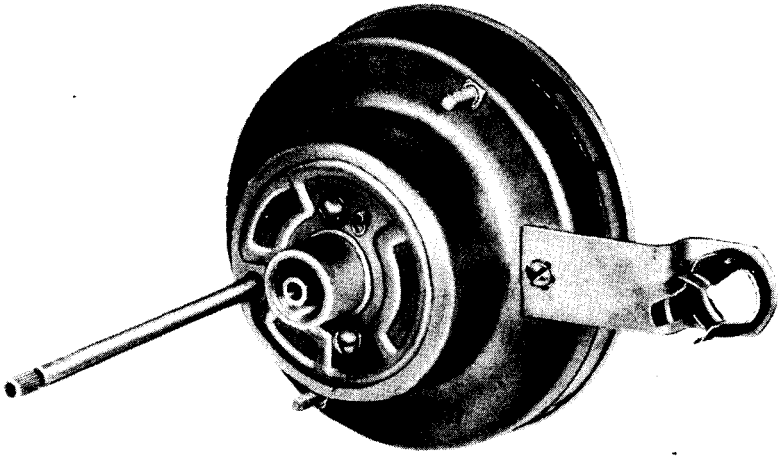
b. Removal of Assembly.

Pliers
Screwdriver
Wrench, open-end, 3/8-in.



RA PD 6215

Figure 142—Speedometer Assembly—Front View



RA PD 6214

Figure 143—Speedometer Assembly—Rear View

(1) REMOVE SPEEDOMETER FLEXIBLE DRIVE SHAFT CONNECTION.
Pliers
Detach speedometer drive shaft connection at speedometer head.

(2) REMOVE LAMP BRACKET.
Screwdriver
Remove screw, remove shakeproof washer holding bracket to speedometer case.

(3) REMOVE SPEEDOMETER AND MOUNTING BRACKETS.
Wrench, open-end, 3/8-in.
Remove two nuts and lock washers from mounting bracket studs, and remove brackets and speedometer assembly.

c. Disassembly of Components (fig. 144).
Pliers Screwdriver

(1) REMOVE SPEEDOMETER ASSEMBLY. Refer to paragraph **b**, above.

(2) REMOVE ROLLED BEZEL GLASS AND GASKETS.
Pliers Screwdriver
Pry bezel loose with screwdriver in two places about one half inch apart. Then grasp with pliers and tear section out (fig. 145a). Pull bezel off. Remove glass and two gaskets.

(3) REMOVE POINTER. Turn pointer to the right as far as it will go. Hold pointer at axis, twist to the right, and carefully pull pointer off (fig. 145 **b**).

(4) REMOVE DIAL.
Screwdriver, small
Remove two screws, and lift off dial.

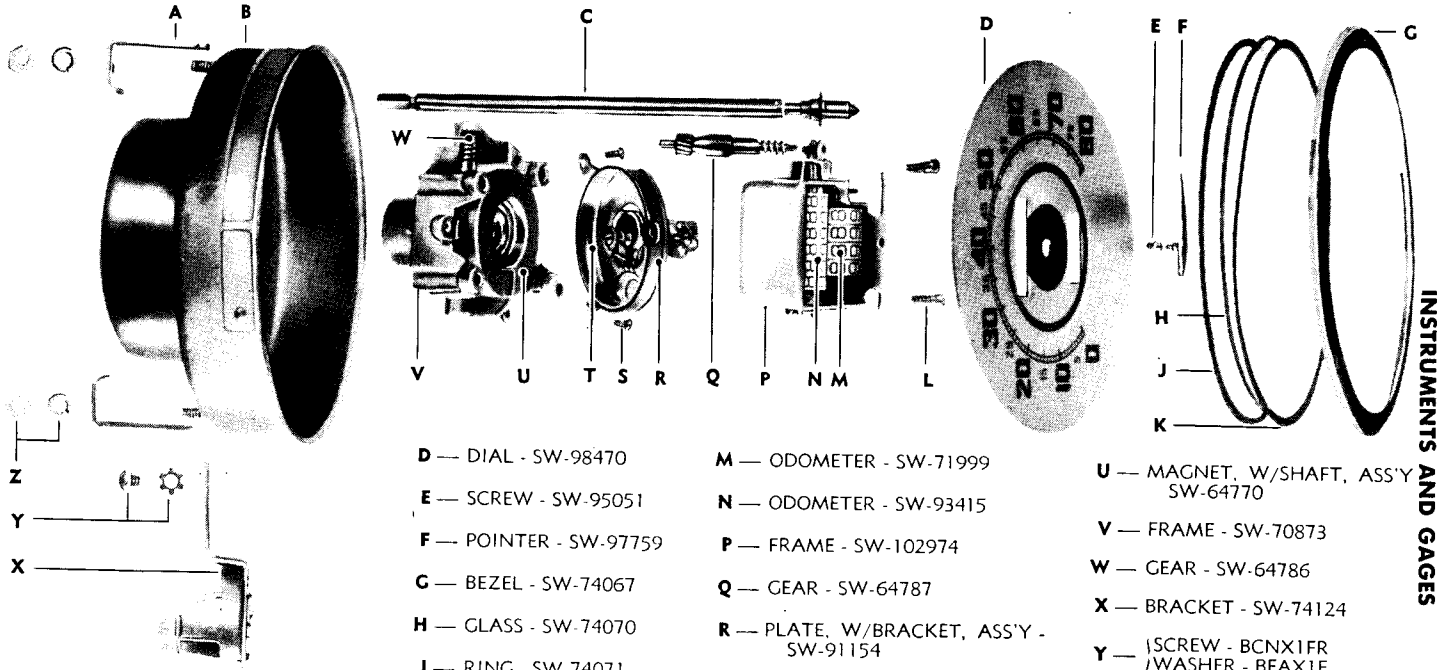
(5) REMOVE ODOMETER ASSEMBLY.
Screwdriver
Remove three odometer frame screws, and lift out odometer assembly (fig. 145c).

(6) REMOVE FIELD PLATE AND BRACKET ASSEMBLY.
Screwdriver
Remove three screws holding field plate bracket to frame, and lift out assembly (fig. 145d).

(7) REMOVE SPEED-UNIT ASSEMBLY AND MOUNTING FRAME.
Screwdriver
Loosen and remove two screws and lock washers from back of case, and lift out speed-unit assembly (fig. 145e).

d. Maintenance and Adjustments.

(1) If the speedometer is not registering the speed of the vehicle and the miles of travel, inspect flexible drive conduit. If found to be hot,



A — BRACKET - SW-740741
B — CASE, ASS'Y, W/STUD, - SW-98473
C — SHAFT - SW-102977

D — DIAL - SW-98470
E — SCREW - SW-95051
F — POINTER - SW-97759
G — BEZEL - SW-74067
H — GLASS - SW-74070
J — RING - SW-74071
K — GASKET - SW-74072
L — SCREW - SW-64796

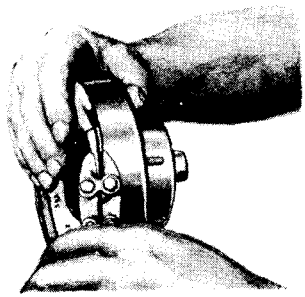
M — ODOMETER - SW-71999
N — ODOMETER - SW-93415
P — FRAME - SW-102974
Q — GEAR - SW-64787
R — PLATE, W/BRACKET, ASS'Y - SW-91154
S — SCREW - SW-18035
T — CUP, W/SHAFT, ASS'Y - SW-91152

U — MAGNET, W/SHAFT, ASS'Y SW-64770
V — FRAME - SW-70873
W — GEAR - SW-64786
X — BRACKET - SW-74124
Y — {SCREW - BCNX1FR / WASHER - BEAX1E
Z — {NUT - BBMX1C / WASHER, LOCK - BECX1E

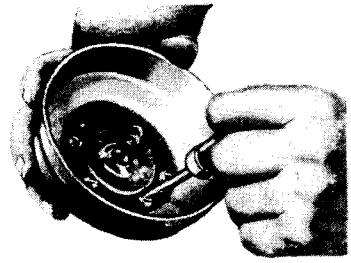
RA PD 6223

Figure 144—Speedometer—Exploded

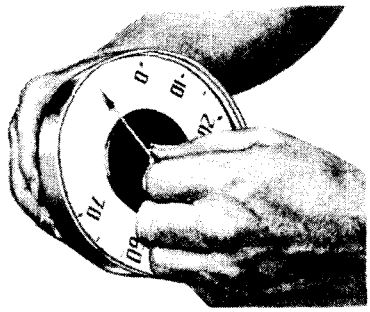
ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES



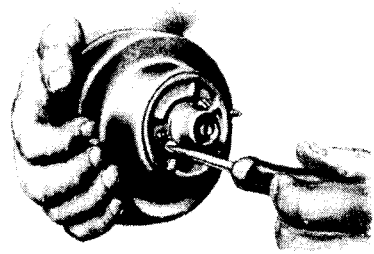
A — BEZEL REMOVAL



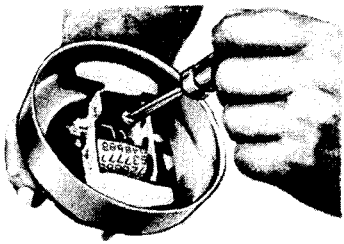
D — SPEED UNIT REMOVAL



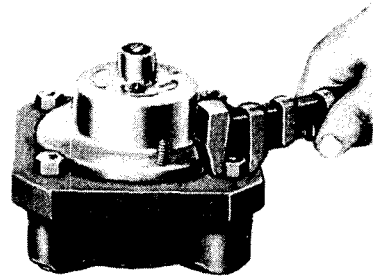
B — NEEDLE REMOVAL



E — CASE REMOVAL



C — ODOMETER REMOVAL



F — TOOL - SW-T88972 BEZEL REPLACEMENT WITH SPECIAL TOOL

RA PD 56192

Figure 145—Speedometer Disassembly

internal friction is developing because of lack of lubrication or maladjustment. If a slight click or thump can be heard, speedometer cable should be removed and inspected for distortion, incorrect length or diameter, and for breaks and worn connections. A defective cable should be replaced.

(2) If speed-unit is out of order, replace speed-unit assembly and bracket.

(3) If the odometer fails to register, replace odometer unit assembly and bracket.

(4) Inspect dial pointer, and if it is loose on shaft, replace pointer.

(5) Replace broken dial glass with new glass and bezel, and if any dust or grit has found its way into the mechanism, disassemble and clean parts thoroughly.

(6) If a new field plate and bracket assembly is installed, the instrument must be accurately calibrated on a calibrating machine.

e. Reassembly (fig. 144).

Screwdriver — Tool, bezel rolling, SW-T88972

(1) REPLACE FIELD PLATE AND BRACKET ASSEMBLY.

Screwdriver

Place field plate bracket on frame, insert three screws, and tighten.

(2) REPLACE ODOMETER ASSEMBLY ON SPEED-UNIT FRAME.

Screwdriver

Place odometer assembly on speed-unit frame, meshing cross drive shaft worm with odometer gear. Insert three screws and tighten.

(3) REPLACE SPEEDOMETER MECHANISM IN CASE.

Screwdriver

Place speedometer in case lining up the trip, and reset stem with the hole in rear of case. Replace lock washers and screws, and tighten.

(4) REPLACE DIAL.

Screwdriver

Place dial on odometer frame so that the long slot in the dial is in line with the season mileage unit. Insert dial screws and tighten.

(5) REPLACE DIAL POINTER.

Start pointer on shaft at about the thirty-mile mark. Press it on as it is turned counterclockwise to zero.

(6) REPLACE GLASS AND BEZEL.

Tool, bezel rolling, SW-T88972

Place new bezel, glass, gaskets, and speedometer, face down, in lower half of tool, and place upper half of tool on lower half. Screw on tool

stud nuts and tighten each nut, a little at a time, to exert even pressure on bezel. After nuts are down tight, remove (fig. 145f).

f. Installation.

Wrench, open-end, 3/8-in.

(1) INSTALL SPEEDOMETER ON INSTRUMENT PANEL.

Wrench, open-end, 3/8-in.

Place speedometer in hole on instrument panel. Slide bracket on mounting studs. Put on two lock washers and stud nuts. Holding brackets in place, tighten nuts. Connect speedometer flexible drive to speedometer fitting, and tighten.

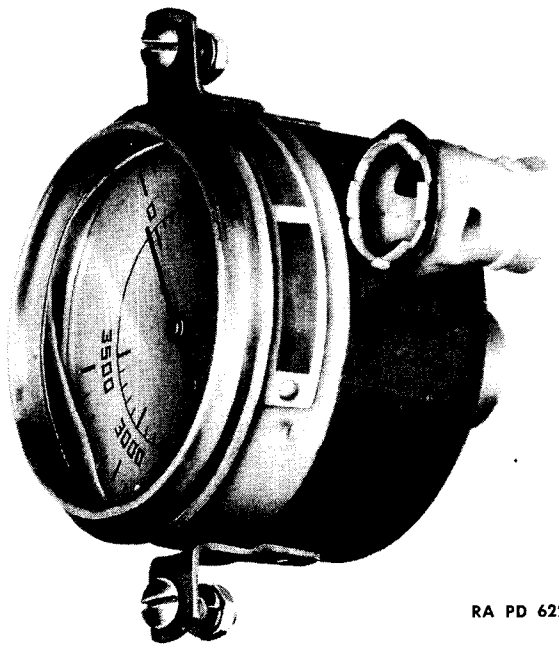
(2) INSTALL LAMP BRACKET AND SOCKET ASSEMBLY.

Place lamp bracket on rear of speedometer case, in line with the screw hole. Insert screw and tighten.

54. TACHOMETER.

a. Description (fig. 146). The tachometer is of the centrifugal magnetic type, and indicates engine revolutions per minute from 0 to 3500.

(1) CONSTRUCTION. The centrifugal magnetic-type tachometer is assembled in a case and consists of a drive shaft and magnet assembly. A speed cup and shaft assembly is mounted in the field plate bracket which is attached to the magnet assembly. The pointer is pressed on the



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Figure 146—Tachometer Assembly

speed cup shaft. The dial is placed on the front of the case and is protected by the bezel and glass assembly. A friction ring holds both the glass and dial in position. Two brackets are attached to the case for mounting it to the panel. Also attached to the case is a bracket for holding the socket and lamp which lights the instrument indirectly.

(2) OPERATION. The tachometer operates on the same principle as the speedometer and indicates the engine revolutions per minute. The tachometer is driven by a flexible shaft connected to a spiral gear drive located in the distributor mounting housing.

(3) SPECIFICATIONS.

Make	Stewart-Warner	White No.	376131
Type	Centrifugal	Autocar No.	16W41210
Manufacturer's No.	SW-598Y	Diamond T No.	N3599
Ordnance No.	C85515		

b. Removal of Assembly.

Wrench, open-end, 3/8-in.

(1) REMOVE SOCKET AND LAMP ASSEMBLY.

Take socket and lamp assembly out of bracket attached to tachometer case.

(2) DISCONNECT FLEXIBLE SHAFT.

Pliers

Disconnect flexible drive shaft connection at tachometer.

(3) REMOVE TACHOMETER.

Wrench, open-end, 3/8-in.

Remove two screws, lock washers, and nuts holding tachometer to panel.

c. Disassembly (fig. 147).

Screwdriver and hammer or tool SW-T42358

(1) REMOVE TACHOMETER FROM INSTRUMENT PANEL.

See paragraph **b**, above.

(2) REMOVE BEZEL.

Pry off bezel

Screwdriver and hammer or tool SW-T42358

(3) REMOVE POINTER AND DIAL ASSEMBLY.

Turn pointer to left counterclockwise as far as it will go. Hold pointer at axis, and twist to left and carefully pull pointer off. Lift off dial.

(4) TACHOMETER MECHANISM.

Screwdriver

Remove two screws from rear of case, and lift out tachometer mechanism.

(5) FIELD PLATE, SPEED CUP AND SHAFT ASSEMBLY.

Screwdriver

Remove the three screws that fasten field plate assembly to frame, and lift off assembly.

d. Maintenance and Adjustments.

(1) If the tachometer fails to indicate engine revolutions per minute, inspect flexible drive as described in paragraph 53 **d** (1). Fluctuation of the pointer when the engine is under load, may be caused by engine missing and may not be the fault of the instrument.

(2) Excessively high revolutions per minute will indicate clutch or some form of engine drive slippage.

(3) If the speed-unit or the speed cup unit fails to operate, replace complete unit assembly. When a speed cup assembly has been replaced, the instrument should be accurately calibrated.

(4) Before replacing broken dial glass, the mechanism should be inspected for dust and dirt. If necessary, disassemble and clean parts thoroughly.

e. Reassembly (fig. 147).

Press Screwdriver

(1) REPLACE FIELD PLATE, SPEED CUP, AND SHAFT ASSEMBLY.

Screwdriver

Place field plate bracket on tachometer frame. Insert three screws, and tighten in position.

(2) REPLACE DIAL AND POINTER.

Place dial in position, start pointer at the 2,500 mark, and press it on as it is turned clockwise to zero.

(3) REPLACE TACHOMETER MECHANISM IN CASE.

Screwdriver

Place tachometer mechanism in case, insert two screws with lock washers, and tighten.

(4) REPLACE BEZEL AND GLASS.

Press.

Place paper gasket, glass, and ring in order named into bezel. Press on bezel with an arbor press.

f. Installation.

Wrench, open-end, 3/8-in.

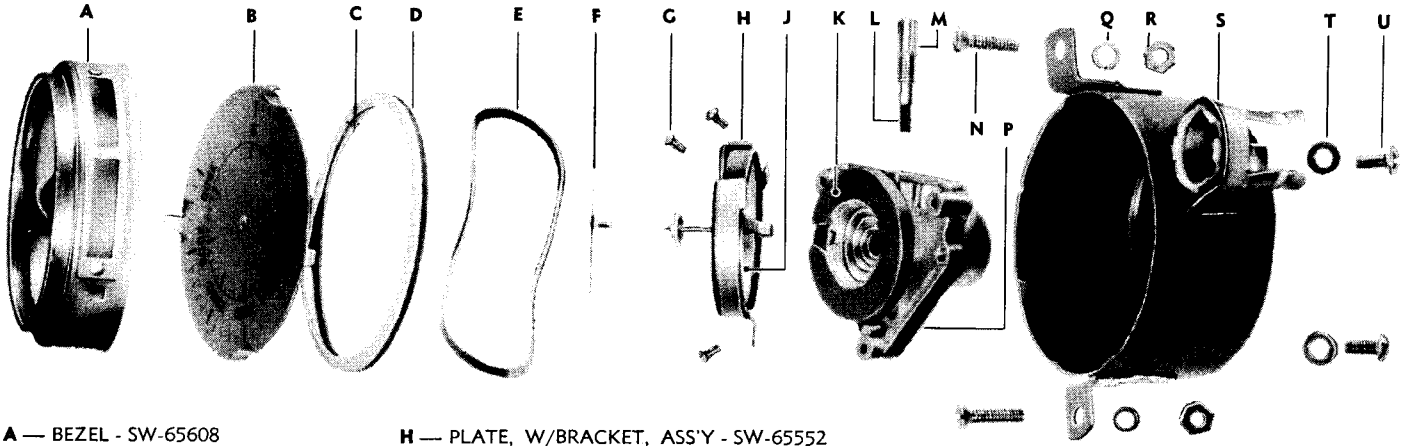
(1) INSTALL TACHOMETER ON INSTRUMENT PANEL.

Wrench, open-end, 3/8-in.

Place tachometer in hole on instrument panel, lining up the holes on the tachometer case ears, with the holes on the panel, and insert screws. Put on lock washers and nuts, and tighten. Connect flexible drive shaft to tachometer, and tighten.

(2) INSTALL TACHOMETER LAMP AND SOCKET.

Insert lamp and socket into lamp bracket attached to tachometer case.



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A — BEZEL - SW-65608

B — DIAL - SW-400646

C — GLASS - SW-65602

D — GASKET - SW-16250

E — RING - SW-65604

F — POINTER - SW-400650

G — SCREW - SW-18035

H — PLATE, W/BRACKET, ASS'Y - SW-65552

J — CUP, W/SHAFT, ASS'Y - SW-65544

K — MAGNET, W/SHAFT, ASS'Y - SW-65571

L — WICK - SW-68239

M — CUP - SW-65533

N — SCREW - A226058

P — FRAME - SW-65570

Q — WASHER, LOCK - BECX1E

R — NUT - BBKX2C

S — CASE, W/BRACKET, ASS'Y - SW-400651

T — WASHER, LOCK - SW-5052

U — SCREW - SW-13395

RA PD 6226

Figure 147—Tachometer—Exploded

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section XII

FRONT SPRINGS AND SHOCK ABSORBERS

	Paragraph
Front springs	55
Shock absorbers	56

55. FRONT SPRINGS.

a. Description. The springs are semielliptical, twin-back type and are used on the front end of the vehicle only.

(1) CONSTRUCTION (fig. 148).

(a) The springs are attached to the frame by means of an anchoring pin at the front end and a shackle and shackle pins at the rear. At the center they are attached to the axle seats by means of U bolts and nuts which also hold the bumpers to the top of the springs.

(b) To provide a tight wrap around the spring eyes sufficient to prevent breakage at these critical points, it is necessary to wrap both the first and second leaves around the bushings at the eyes (three leaves wrapped in later production vehicles). To take care of lengthening and shortening of the first and second leafs during flexing and still provide a tight wrap, it is necessary to split the second leaf into three sections. The center of the leaf is an H-shaped section slightly thicker than the two other end sections of this second leaf. The tang-ends of the outer sections are allowed to slide in the recesses formed by the H. The joint formed between the center section and the two outer sections of the second leaf gives the impression of a broken spring leaf, and may lead to complaints resulting from a misunderstanding of the basic principle concerned. A wear plate is assembled between the H section of the second wrapper leaf and the main wrapper leaf. The leaves are bolted together at the center and held by four clips along the length, two clips between the center and each end.

(2) OPERATION. The springs flex with every movement of the wheels and prevent the frame from taking the jolts. The second wrapper leaf is split as explained above and slips back and forth with each flexing of the spring and thus prevents excessive breaking of leaves. When the wheels drop into a deep hole or hit a sharp bump in the terrain, the shock absorbers may not be able to cushion the entire jolt, and the springs will then flex until the bumpers on top of the springs hit the bottom of the frame. This prevents any further flexing of the springs which might break them, but the frame is then subjected to the shock.

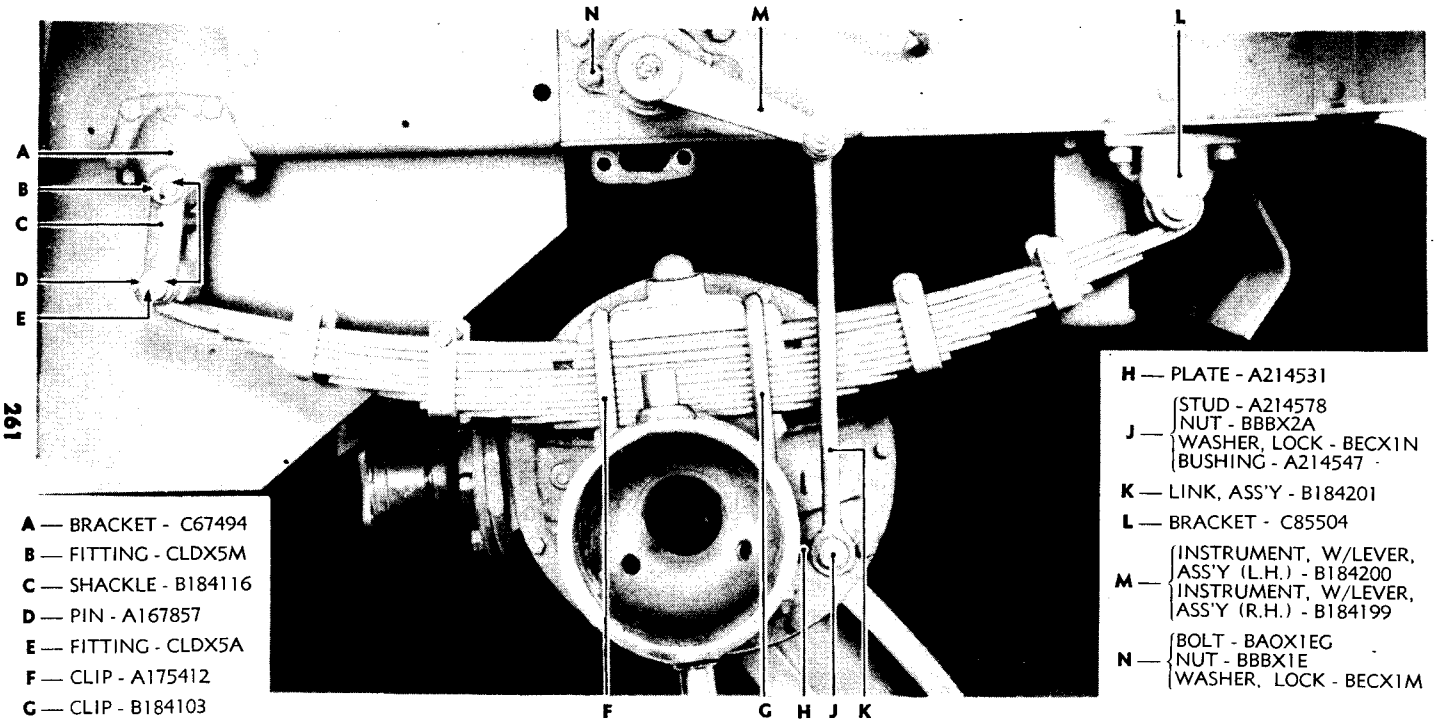


Figure 148—Front Spring and Shock Absorber—Installed

(3) SPECIFICATIONS.

Make Eaton Mfg. Co.	Ordnance No. B184104
Type Twin-back	White No. 371633
Manufacturer's No.	Autocar No. 13W309
Early production vehicles Eat.-32634	Diamond T No. N7140
Later production vehicles (three wrapped leaves) .. B184530	

FRONT SPRING

Center to center of eye .. 37 in.	Width 2¼ in.
Center of front eye to seat center 18 in.	Rebound clips 4 in.

LEAVES

Quantity 11	Wear plate thickness .. 0.031 in.
Thickness 6@0.291 in., 5@0.262 in.	Total thickness of spring 3.119 in.
H-Plate thickness 0.323 in.	

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) HARD RIDING	
Insufficient lubrication.	Lubricate shackle pins.
Broken shackle pins.	Replace with new pins.
Broken bracket bolts.	Replace with new bolts.
Overloading or uneven load distribution.	Redistribute load.
(2) OVERFLEXIBILITY	
Broken spring leaves.	Replace broken leaves.

c. Removal of Assembly (fig. 149).

Drift, brass	Pliers
Hammer	Wrench, open-end, $1\frac{5}{16}$-in.
Jack, hydraulic	Wrench, socket, $1\frac{5}{16}$-in.

(1) JACK-UP VEHICLE.

Jack, hydraulic

Place jack under frame just back of spring to be removed. Raise jack until all load is removed from spring.

(2) REMOVE U BOLT CLIPS.

Wrench, socket, $1\frac{5}{16}$-in.

Take off U bolt nuts, and lock washers, and remove front U clip, rear U clip, and bumper.

(3) REMOVE SHACKLE AND BRACKET PINS AND SPRING ASSEMBLY.

Drift, brass
Hammer
Pliers
Wrench, open-end, $\frac{5}{8}$-in.

Pull out shackle and bracket pin cotter pins, and remove nuts. Drive out pins from spring eyes and lower spring assembly.

d. Disassembly.

Chisel, cold.
Drift
Hammer
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, $\frac{11}{16}$-in.

(1) REMOVE SPRING FROM VEHICLE.

Follow paragraph **c**, above.

(2) REMOVE SPRING EYE BUSHINGS.

Drift
Hammer

Drive bushings out of spring eyes.

(3) DISASSEMBLE SPRING LEAVES.

Drift, brass
Hammer
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, $\frac{11}{16}$-in.

Remove spring clip bolts, nuts, and spacers. Remove center bolt and nut, and separate leaves. Drive second wrapper leaf off first wrapper leaf eyes with a hammer and drift. The clips come away with the leaves to which they are riveted.

(4) SEPARATE CLIPS FROM LEAVES.

Chisel, cold
Hammer

If necessary to replace clips or the leaves to which they are riveted, cut rivets holding clips to leaves, and remove clips.

e. Maintenance and Adjustments.

(1) Check the U bolts (clips) for breakage and their nuts for tightness; the nuts should be tightened periodically. Loose U bolts permit the leaves to shift and shear the center bolt, may result in causing misalinement of the axle with the frame. This may result in broken leaves and improper wheel alinement.

(2) Inspect spring-eye bushings for wear, and replace any which are oversize beyond the allowable tolerance.

(3) Check shackle pins for wear, breakage and plugged lubrication passages. Replace broken or excessively worn pins, and clean out any plugged lubrication passage.

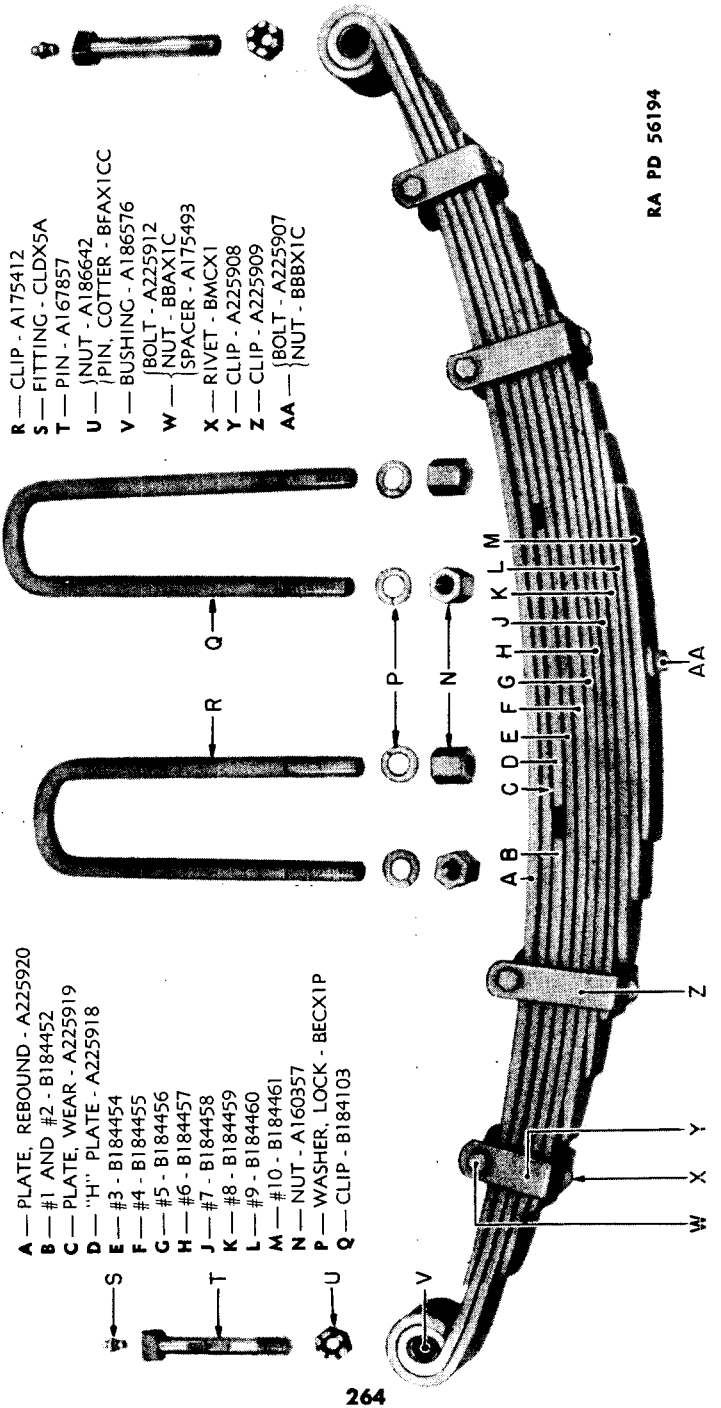


Figure 149—Front Spring Details

(4) Inspect the rubber bumpers for indications of excessive bumping. If any is evident or if the bumpers are missing, check for broken leaves or leaves which have taken a permanent set. These should be replaced with new leaves.

f. Reassembly.

Hammer, riveting
Press
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, $\frac{11}{16}$-in.

(1) ATTACH CLIPS TO THEIR RESPECTIVE LEAVES.

Hammer, riveting.

Rivet clips to leaves and smooth down inner ends of rivets.

(2) TIE LEAVES TOGETHER.

Press
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, $\frac{11}{16}$-in.

Press second wrapper leaf eyes onto first wrapper leaf. Stack leaves together in their correct order, and replace center bolt and nut. Replace bolts, spacers, and nuts in clips along length of spring, and tighten entire assembly.

(3) REPLACE BUSHINGS.

Press

Press bushings into spring eyes.

g. Installation of Assembly.

Hammer
Pliers
Wrench, open-end, $\frac{15}{16}$-in.
Wrench, socket, $\frac{15}{16}$-in.

(1) ATTACH SPRING ASSEMBLY TO FRAME.

Hammer
Pliers
Wrench, open-end, $\frac{15}{16}$-in.

Hold spring in position, and tap pins into shackle and bracket. Turn shackle pin nuts up tight, and then back them off one-half turn to prevent any binding. Replace cotter pins in shackle pins. Always use new cotter pins.

(2) ATTACH SPRING TO AXLE ASSEMBLY.

Wrench, socket, $\frac{15}{16}$-in.

Set bumper on top center of spring, and straddle it and spring with U bolts (clips) which then pass down through holes in axle housing. Replace U bolt lock washers and nuts, and tighten down assembly.

(3) REMOVE JACK.

Lower jack until weight of car rests on spring and then pull out jack.

56. SHOCK ABSORBERS.

a. Description (fig. 148). The shock absorbers are of the standard, Houdaille, double acting type.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

(1) CONSTRUCTION.

(a) The working chamber, the heart of the instrument, is divided into two equal sections by a stationary partition. There is also a moving wing (or quarter section) which is oscillated by the arm or lever of the instrument. The chamber is filled with a special fluid. In the stationary partition two automatic check valves are located, which permit the fluid to flow freely in one direction but close completely the instant the flow of fluid is reversed. The check valves are so arranged that they will permit a retarded flow of fluid. Air elimination is accomplished by means of an air vent located at the top of the partition which divides the working chamber from the reserve chamber. Replenishing valves are located at the bottom of the partition.

(b) The instrument is bolted to the frame above the spring and is attached to the spring holding U bolts at the bottom of the axle spring seat by means of a connecting link and plate (figs. 148 and 150). The upper end of the connecting link is held to the instrument arm by a special bolt, lock washer, and nut. The lower end of the link is attached to the clip plate in the same manner, and this plate is held to the bottom of the axle seat by the U bolt nuts and lock washers.

(2) OPERATION. These shock absorbers control the action of the springs by cushioning the compression and checking the rebound. The resistance is not equal both ways, being less on compression of the springs. The resistance is developed by the fluid in the compression chamber being forced through the check valves into the noncompression chamber as soon as the springs are compressed and impart motion to the lever arm by means of the connecting link. At the instant the lever arm is moved in the reversed direction, downward, caused by the spring recoil, the check valves close completely, stopping the fluid flow, with the result that the spring during rebound is under control in proportion to the shock resistance. The resistance automatically changes to govern the varying spring movements, whether slight or violent.

(3) SPECIFICATIONS.

Make Houdaille
Type Double acting
Manufacturer's No.
L. H. A8125
R. H. A8126
Ordnance No.
L. H. C85510
R. H. C85511
White No.
L. H. 376100
R. H. 376101
Autocar No.
L. H. 28W4200
R. H. 28W4100
Diamond T No.
L. H. N1524
R. H. N1524

FRONT SPRINGS AND SHOCK ABSORBERS

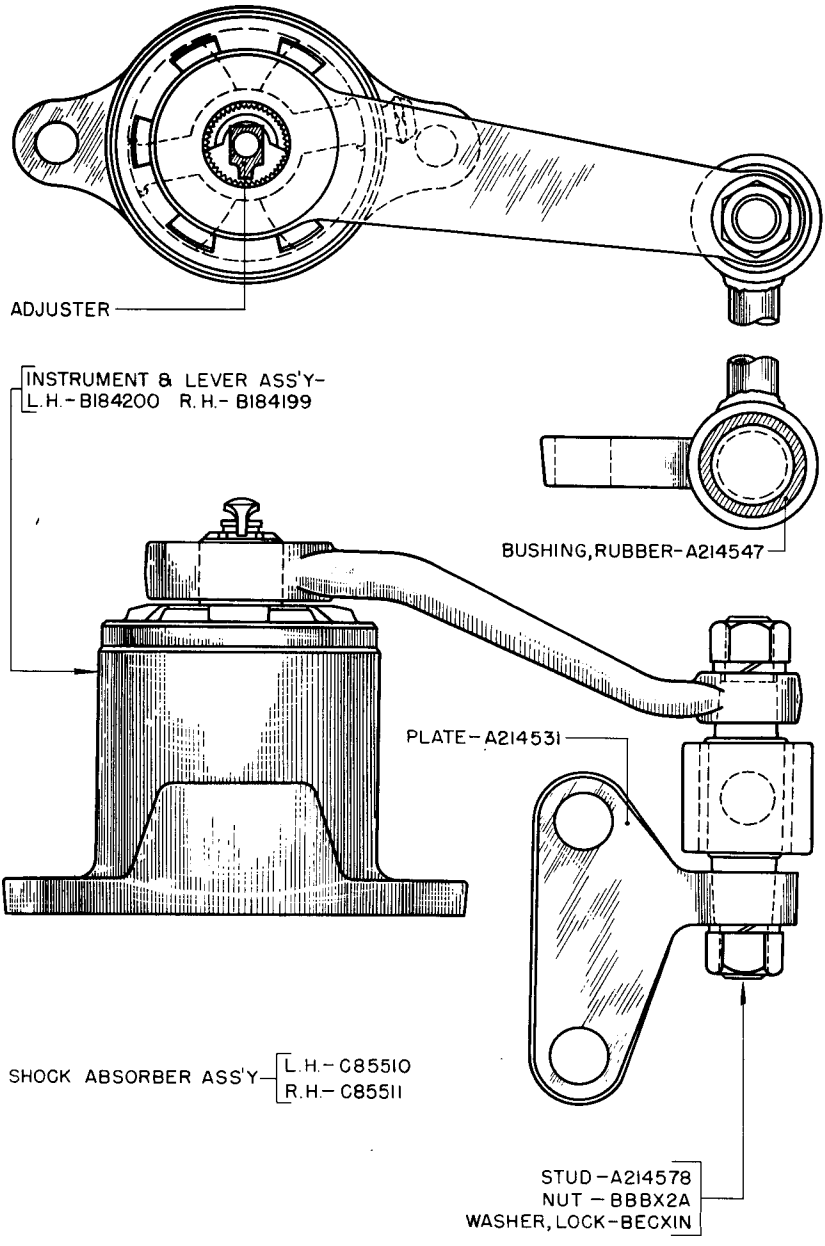


Figure 150—Shock Absorber Assembly

b. Trouble Shooting.

Symptom and probable cause	Probable remedy
(1) OVERFLEXIBILITY	
Lack of fluid in shock absorbers.	Refill reservoir with Houdaille Fluid.
Damaged or worn internal shock absorber part.	Replace with new unit.

c. Removal of Assembly.

Jack, hydraulic
Wrench, open-end, $\frac{13}{16}$-in.
Wrench, socket, $\frac{13}{16}$-in.
Wrench, socket, $\frac{15}{16}$-in.

(1) JACK UP VEHICLE FRONT END.
Jack, hydraulic
See paragraph c (1), above.

(2) DISCONNECT CLIP PLATE AT BOTTOM OF AXLE SPRING SEAT.
Wrench, socket, $\frac{15}{16}$-in.
Remove bolts and lock washers from front U bolt (clip), and disconnect connecting link clip plate.

(3) REMOVE SHOCK ABSORBER ASSEMBLY.
Wrench, open-end, $\frac{13}{16}$-in.
Wrench, socket, $\frac{13}{16}$-in.
Remove bolts, nuts, and lock washers holding assembly to frame and drop assembly.

d. Disassembly.

Hammer, soft metal
Wrench, socket, $\frac{7}{8}$-in.

(1) REMOVE INSTRUMENT ASSEMBLY FROM VEHICLE.
Follow steps in paragraph c, above.

(2) DISCONNECT CLIP PLATE.
Hammer, soft metal
Wrench, socket, $\frac{7}{8}$-in.
Remove stud nut and lock washer holding plate to connecting link assembly, and remove plate. Drive stud out of connecting link and remove rubber bushing.

(3) DISCONNECT INSTRUMENT LEVER ARM FROM LINK.
Hammer, soft metal
Wrench, socket, $\frac{7}{8}$-in.
Follow procedure similar to that given in paragraph d (2), above.

NOTE: The instrument should not be disassembled beyond this point unless the work is done by an expert with the proper tools. The instrument should preferably be returned to the manufacturer for internal repairs.

FRONT SPRINGS AND SHOCK ABSORBERS

e. Maintenance and Adjustments.

(1) Check connecting link, studs, and bushings for wear and damage; if any wear or damage is evident, replace with new parts.

(2) The fluid level should be checked and replenished, if necessary, every 5,000 miles, using the following procedure:

(*a*) Clean the part of the instrument around the filler plug thoroughly before removing the plug. An ordinary paint brush, dipped in SOLVENT, dry-cleaning, will remove most of the dirt. Then use compressed air or a clean cloth to remove small particles of dirt.

(*b*) Use Houde Fluid Gun ♯HEC-4902, and refill units with Houdaille shock absorber fluid only.

(*c*) In order to remove any air that may be trapped in the working chamber, disconnect link, and pump lever several times through full range of travel. This will draw the fluid from the auxiliary reservoir of the working chamber; add more fluid and continue pumping. When the working chamber is properly filled, there will be uniform resistance and no rubbery feeling of lost motion. Refill reservoir to bottom of filler plug hole.

(d) CAUTION: Do not fill reservoir above plug hole level, since this may cause it to leak. The space between the fluid and the top of the reservoir is air space, for expansion of the fluid.

(3) Adjustments are made in the following manner:

(*a*) The valve adjustments on the shock absorber resistance made at the factory are expected to meet the demands for average general requirements. However, adjustments can be made to meet special operating conditions. To adjust the shock absorber operating mechanisms, the valve indicator on the outside of the instrument is rotated between the two stops.

(*b*) To obtain a stiffer ride, or when the temperatures are above 100 F, increase resistance by turning pointer clockwise from the factory setting mark. Do this in small steps of $\frac{1}{16}$ inch at a time, riding the vehicle between adjustments, if possible.

(*c*) To obtain a softer ride, or when the temperature is well below freezing, decrease the resistance by turning the pointer counterclockwise from the factory setting mark, to give the desired control.

f. Reassembly.

Hammer, soft metal — Wrench, socket, $\frac{7}{8}$-in.

(1) ATTACH CONNECTING LINK TO LEVER ARM.

Hammer, soft metal — Wrench, socket, $\frac{7}{8}$-in.

Replace bushing in connecting link; be certain it is evenly spaced from ends of hole. Tap stud into link, and insert stud through lever arm. Replace stud nut and lock washer.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

(2) REPLACE CLIP PLATE.

Hammer, soft metal — Wrench, socket, 7/8-in.

Attach clip plate to link by following procedure used to attach lever arm in preceding step.

(3) REPLACE ASSEMBLY.

See paragraph g, below.

g. Installation of Assembly.

Wrench, open-end, 13/16-in. — Wrench, socket, 13/16-in.
Wrench, socket, 13/16-in.

(1) ATTACH INSTRUMENT TO FRAME.

Wrench, open-end, 13/16-in. — Wrench, socket, 13/16-in.

Hold assembly in position, and fasten with bolts, lock washers, and nuts.

(2) ATTACH CLIP PLATE AT BOTTOM OF U BOLT.

Wrench, socket, 15/16-in.

Slide clip plate onto front U bolt (clip), and replace lock washers and nuts. Be sure nuts are tight.

(3) LOWER FRONT END OF VEHICLE.

Lower jack until front end of car rests on springs, and then pull out jack.

Section XIII

STEERING GEAR AND DRAG LINK

	Paragraph
Description	57
Trouble shooting	58
Removal of assembly	59
Disassembly of components	60
Maintenance and adjustments	61
Reassembly of components	62
Installation of assemblies	63

57. DESCRIPTION (fig. 151).

a. Construction.

(1) STEERING GEAR. This is of the cam and lever design, twin lever type. The cam is integrally welded to the steering wheel tube and is mounted between two ball bearings which are adjustable by means of shims between the housing and upper cover. The steering wheel tube is encased and supported by the outer jacket housing. The pitch of the cylindrical cam is not constant but is less at the center than it is at the ends; that is, the cam groove is cut at a smaller angle at the midway point between the ends than at the ends of the cam. This provides a variable gear ratio between the straight-ahead driving position and turning or parking positions. The purpose of this construction is to obtain a larger gear reduction for the normal straight-ahead position, thereby reducing road shock, promoting easy steering, and preventing wander. The smaller gear reduction at the turning and parking range of the cam promotes quick and easy steering on turns. The cam groove is ground slightly higher in the normal straight-ahead driving range to provide a closer adjustment of the clearance between the studs and cam at the point of steering action. Two studs mounted on the lever shaft engage the cam groove. The clearance between the cam and studs is adjustable by means of the screw and lock nut mounted on the housing side cover. The lever shaft is mounted in two steel-backed Babbitt bushings. The steering arm is attached to the splined end of the lever shaft and secured by a nut and lock washer. An oil seal is provided on the shaft at the outer end.

(2) DRAG LINK (fig. 152). This is of the tubular type, with adjustable ball sockets which are spring-loaded. At the axle end the spring and spacer are assembled between the ball seat and rod end (bottom of

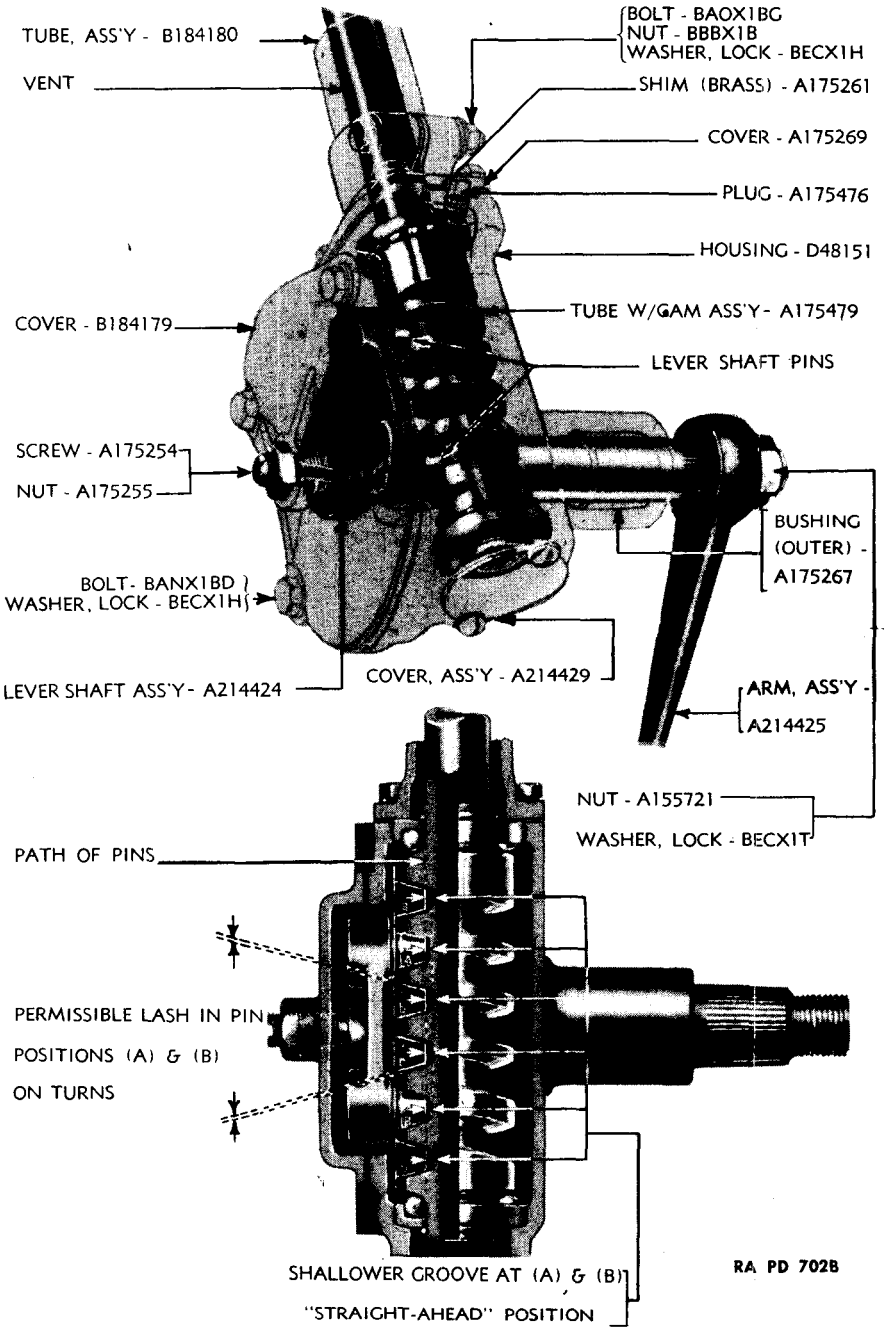
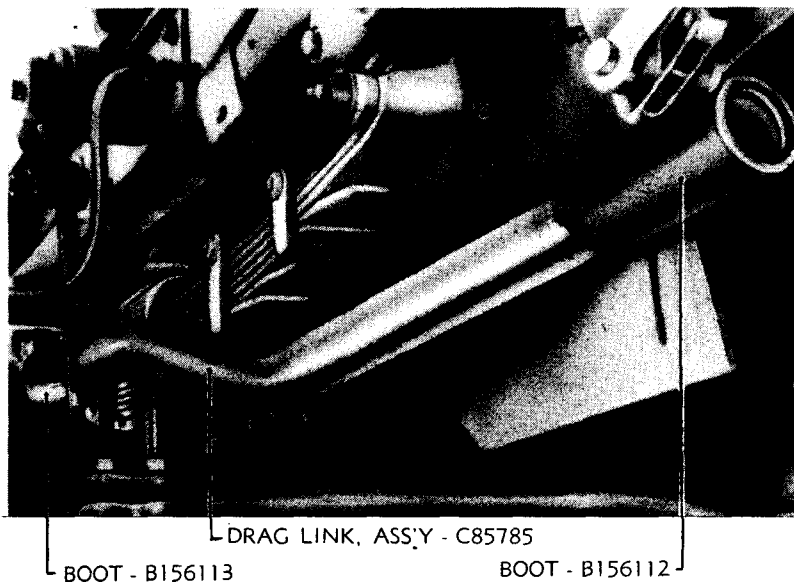


Figure 151—Steering Gear Assembly—Sectionalized



RA PD 54073

Figure 152—Drag Link—Installed

socket). At the steering gear end the spring and spacer are between the ball seat and end plug. A leather boot is laced onto each end of the link to keep out dust and grime.

b. Operation.

(1) STEERING GEAR. Turning the steering tube by means of the steering wheel moves the tapered studs of the lever shaft through the cam on the groove, thus rotating the lever shaft and providing angular movement of the steering arm. The two studs engage the cam for normal straight-ahead driving. The unit pressure on the studs and cam groove sides is therefore lower for this position where most of the steer action occurs. As the steering action moves into the parking range, one of the studs disengages the cam (moves out of the end of the groove) and the other stud moves above the cam axis, thereby greatly increasing the effective leverage.

(2) DRAG LINK. This is the connection link between the steering gear and the steering arm on the front axle steering knuckle. It is connected to and receives its forward and backward motions from the lever shaft arm. These motions are transmitted to the steering arm which rotates the steering knuckles, and this in turn causes the wheels to turn.

c. **Specifications.**

(1) STEERING GEAR.

Make . . Ross Gear and Tool Co.
Model Series T-26
Number T-27134
Type Cam and twin lever
Ordnance No. C85502

Bearings
Cam Ball
Ball diameter, 3/8 in.
Number of balls, 28
Lever shaft Bushings
Steering Wheel
Diameter 18 in.

(2) DRAG LINK.

Make . Thompson Products Co.
Type Spring loaded
Ordnance No.
C85500 and C85785

NOTE: The drag links on vehicles in current production are of heavier construction. Replacement of drag links on earlier vehicles will also be made by the new assembly (Ordnance No. C85785).

58. TROUBLE SHOOTING.

a. Symptom and probable cause	Probable remedy
(1) SHIMMY.	
Tire or wheel out of balance.	Test and balance.
Drag link adjustment loose.	Readjust.
Improper steering gear adjustment.	Check and adjust.
Low or unequal tire inflation.	Check and inflate.
Improperly acting shock absorbers.	Adjust, repair, or replace.
Weak or broken springs.	Replace springs.
Incorrect toe-in.	Adjust.
Worn lever shaft.	Replace.
Worn or scored steering gear housing bushings.	Replace.
Worn bearing in top end of steering gear jacket tube.	Replace bearing.
Upper end of wheel tube worn.	Replace tube.
Drag link ball seats worn.	Replace.
(2) PULL TO ONE SIDE	
Unequal camber.	See TM 9-1710, section V, Front Axle, "Wheel alinement."

STEERING GEAR AND DRAG LINK

Symptom and probable cause	Probable remedy
Unequal caster.	See TM 9-1710, section V, Front Axle, "Wheel alinement."
Unequal tire inflation.	Check.
Dragging brake.	Adjust.
Tight wheel bearing.	Adjust.
(3) WANDER OR WEAVING.	
Insufficient or reversed caster.	See TM 9-1710, section V, Front axle, "Wheel alinement."
Improper or unequal camber.	See TM 9-1710, section V, Front axle, "Wheel alinement."
Twisted axle.	Straighten or replace.
Low or unequal tire pressures.	Check and inflate.
Excessive tightness in steering system.	Adjust.
Loose steering linkage.	Adjust drag link.
Worn steering gear lever shaft studs.	Replace or adjust.
Excessive play in steering gear.	Adjust.
Fit of lever shaft in housing bushings too loose.	Replace bushings.
Worn steering arm ball.	Replace arm.
(4) ROAD SHOCK.	
Steering linkage too tight.	Adjust.
Misalined drag link.	Repair or replace.
Excessive spring flexibility.	Tighten or replace.
Improperly acting shock absorber.	Adjust or replace.
(5) HARD STEERING.	
Lack of lubrication.	Lubricate tie rod yoke, steering gear, and drag link.
Excessive tightness in system.	Adjust.
Unequal or reverse caster.	See TM 9-1710, section V, Front Axle, "Wheel alinement."
Steering gear cam thread dented from heavy blows, chipped, or scored.	Replace.

Ball races at ends of cam dented, pitted, or worn.	Replace.
Lever shaft studs chipped or worn.	Replace lever shaft.

(6) OIL LEAKS.

Worn oil seals.	Replace.

b. Procedure. To locate the general source of trouble, whether it is in the front axle, wheels, or steering system, disconnect the drag link from the steering arm ball. If any difficulty is then encountered in spinning the steering wheel, or if end play of the steering gear cam and tube or lever shaft is found, the trouble may be assumed to be in the steering gear. However, wheel alinement, wheel bearing adjustment, steering knuckle adjustment, and tire inflation should be checked also.

59. REMOVAL OF ASSEMBLY.

a. Drag Link.

Pliers
Wrench, plug, or large screwdriver

(1) REMOVE COTTER PINS.

Pliers

Unlace drag link boots, and remove. Pull out cotter pin at each end of link.

(2) REMOVE ASSEMBLY.

Wrench, plug, or large screwdriver

Loosen adjusting plugs, slip link from front axle steering arm ball, and from steering gear arm.

b. Steering Gear.

Pliers, spring pull-back
Puller, wheel
Screwdriver
Wrench, open-end, 3/4-in.
Wrench, socket, 9/16-in.
Wrench, socket, 7/8-in.
Wrench, socket, 1 1/4-in.

(1) REMOVE HORN BUTTON (fig. 153).

Disconnect horn button cable at bottom of steering gear housing. Depress button and rotate one-sixth turn. This permits removal of button, cup, spring, and cap.

(2) REMOVE STEERING WHEEL NUT (fig. 153).

Screwdriver
Wrench, socket, 1 1/4-in.

Take out three screws holding horn button base plate, and remove plate, spring, washer, and steering wheel nut.

(3) REMOVE STEERING WHEEL.

Puller, wheel

Set up the wheel puller and remove wheel.

STEERING GEAR AND DRAG LINK

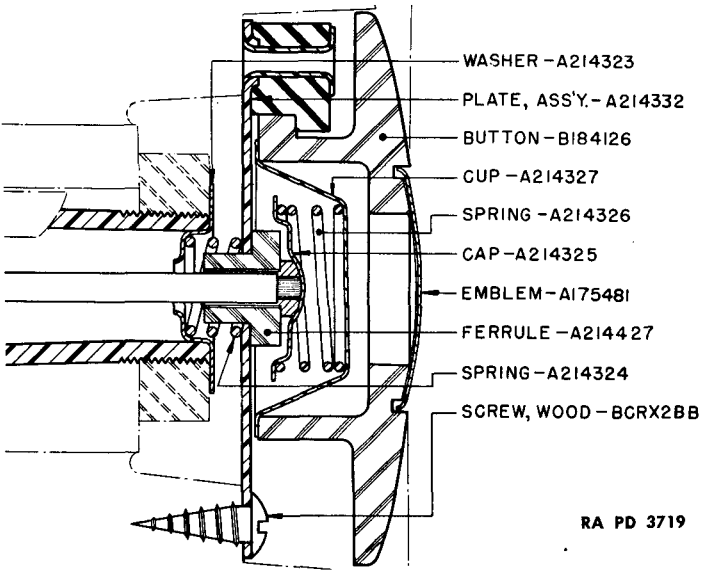


Figure 153—Horn Button—Sectionalized

(4) REMOVE SPRINGS AND U BOLT.

Pliers, spring pull-back — Wrench, socket, $\frac{9}{16}$-in.

Release clutch and brake pull-back springs (fig. 154). Remove U bolt nuts and lock washers at steering column support and pull out U bolt (fig. 155).

(5) REMOVE STEERING GEAR.

Wrench, open-end, ¾-in. — Wrench, socket, ⅞-in.

Remove cap stud nuts and lock washers holding frame bracket cap, and remove cap (fig. 156). Then take out screw lock washer and nut holding steering gear housing to frame bracket, and lower gear assembly to floor.

60. DISASSEMBLY OF COMPONENTS.

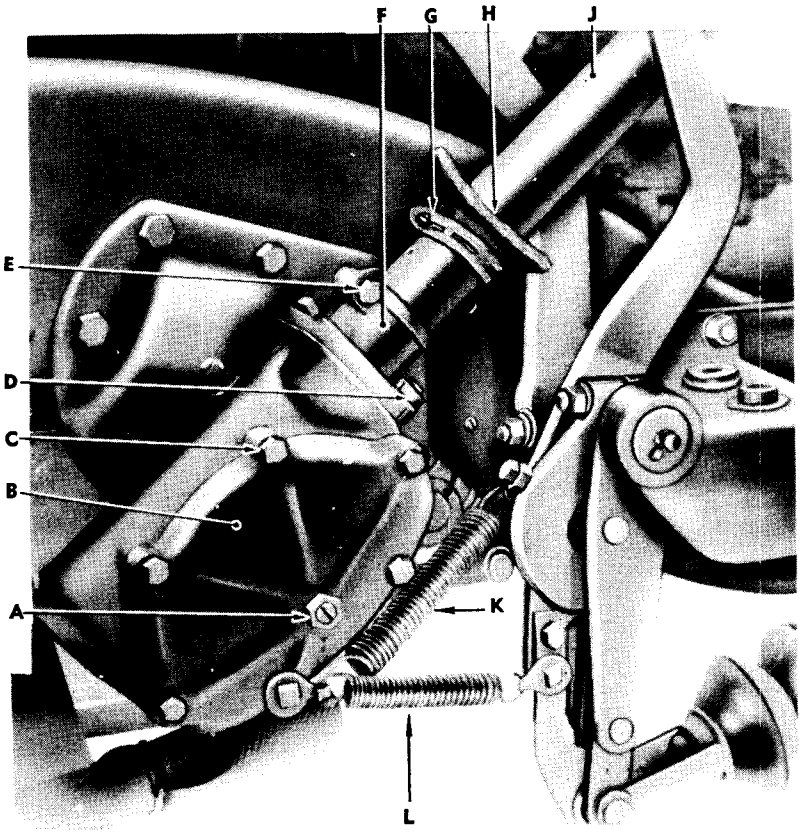
a. Steering Gear (fig. 157).

Adjuster, drag link or wide screwdriver
Drift, brass
File, light
Hammer
Pliers, long nose
Puller, small
Pullers, bearing, spring-type
Screwdriver
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, $\frac{7}{16}$-in.
Wrench, socket, ½-in.

(1) REMOVE JACKET TUBE.

Wrench, open-end, ½-in. — Wrench, socket, ½-in.

Loosen upper cover clamp bolt and nut, and pull out jacket tube.



A — {SCREW - A175254
NUT, LOCK - A175255

B — {COVER - B184179
GASKET - B167676

C — {SCREW, CAP - BCAX1BD
WASHER, LOCK - BECX1H

D — {SCREW - BCBX1CC
WASHER, LOCK - BECX1K

E — {SCREW - BCBX1BG
NUT - BBBX1B
WASHER, LOCK - BECX1H

F — COVER - A175269

G — CLAMP - A167616

H — PAD - B184113

J — TUBE, ASS'Y - B184180

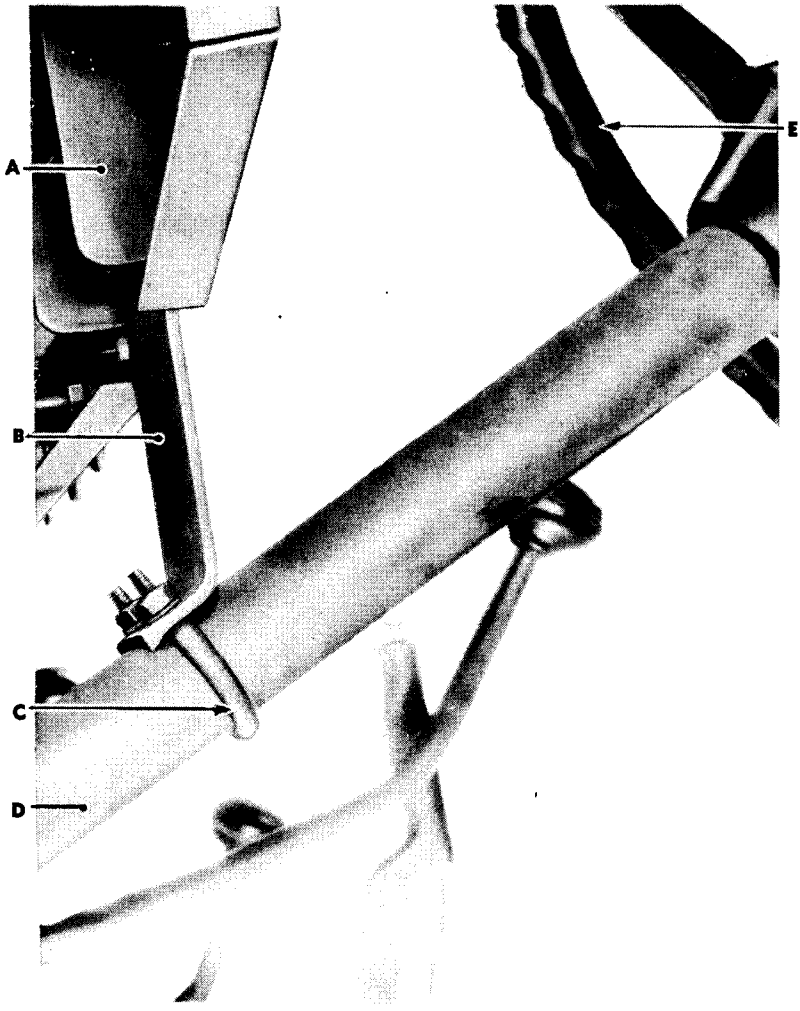
K — SPRING - B167775

L — SPRING - B184320

RA PD 3612A

Figure 154—Steering Gear—Installed

STEERING GEAR AND DRAG LINK



A — BRACKET - C67587

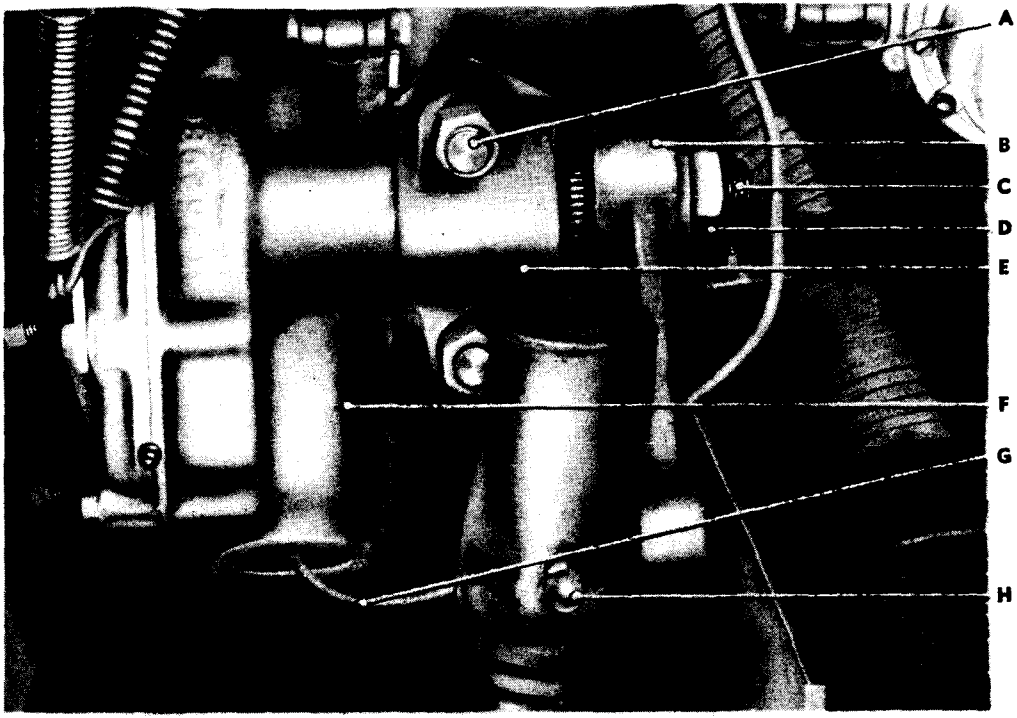
B — SUPPORT - C67588

C — U-BOLT - A167836
NUT - BBBX1B
WASHER, LOCK - BECX1H

D — TUBE, ASS'Y - B184180

E — WHEEL - D48123 RA PD 6398

Figure 155—Steering Gear Jacket Tube (Steering Column)—Installed



A — STUD - A186606
NUT - BBBX2A
WASHER, LOCK - BECX1N

B — ARM ASS'Y - A214425

C — LEVER SHAFT ASS'Y - A214424

D — NUT - A155721
WASHER, LOCK - BECX2T

E — CAP - B184124
SHIM - A215358
BUSHING - A214312

F — HOUSING, ASS'Y - D48151
BUSHING - A175266
BUSHING - A175267
END COVER, W/TUBE ASS'Y A214429

G — CABLE, ASS'Y - A214428

H — FITTING - CLDX5M

RA PD 3706A

Figure 156—Steering Gear Linkage—Installed

(2) REMOVE BEARING UNIT FROM TUBE.

Pullers, bearing, spring-type

Take out spring and spring seat, and then pull out bearing unit (fig. 158).

(3) REMOVE HOUSING UPPER COVER.

Wrench, open-end, $\frac{9}{16}$-in.

Remove four $\frac{3}{8}$-inch screws and lock washers from housing upper cover and take off cover and adjusting shims.

(4) REMOVE HOUSING SIDE COVER.

Wrench, socket, $\frac{1}{2}$-in.

Take out six $\frac{5}{16}$-inch cap screws and lock washers, and remove side cover and gasket.

(5) REMOVE STEERING ARM ASSEMBLY AND LEVER SHAFT.

File, light
Puller, small
Wrench, socket, $\frac{7}{16}$-in.

Take off lever shaft nut and lock washer. Dress end of lever shaft splines with a file to remove any burs and pull off steering arm assembly with a small puller. Remove lever shaft assembly from opposite side of gear case.

(6) REMOVE CAM AND WHEEL TUBE ASSEMBLY.

After lever shaft has been removed, the tube assembly can be withdrawn from housing.

(7) DISASSEMBLE BEARINGS.

Pliers, long nose
Screwdriver

Remove bearing retaining rings, bearing cups and balls.

(8) REMOVE HOUSING BUSHINGS.

Drift, brass
Hammer

Drive out inner and outer bushing and oil seal from housing.

b. Drag Link (fig. 159).

Adjuster, drag link or wide screwdriver

(1) REMOVE WORKING PARTS OF LINK.

Adjuster, drag link or wide screwdriver

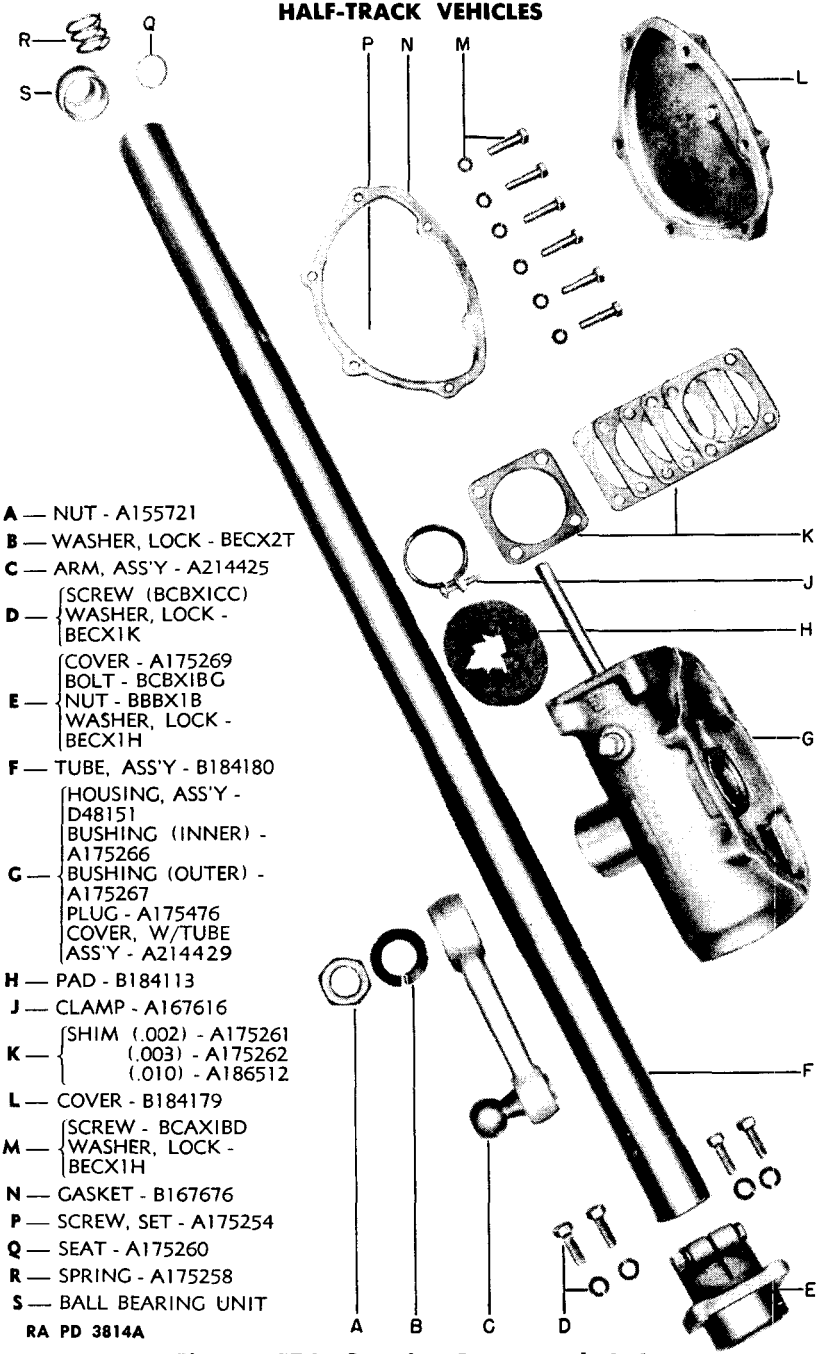
Remove cotter pins, turn out adjusting plugs, and shake out two bearing seats, spacer, spring, and bumper seat from each end of link.

61. MAINTENANCE AND ADJUSTMENTS.

a. Steering Gear Maintenance.

(1) AFTER DISASSEMBLY, USE SOLVENT, DRY-CLEANING, TO CLEAN ALL PARTS THOROUGHLY OF GREASE, OIL, AND DIRT.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

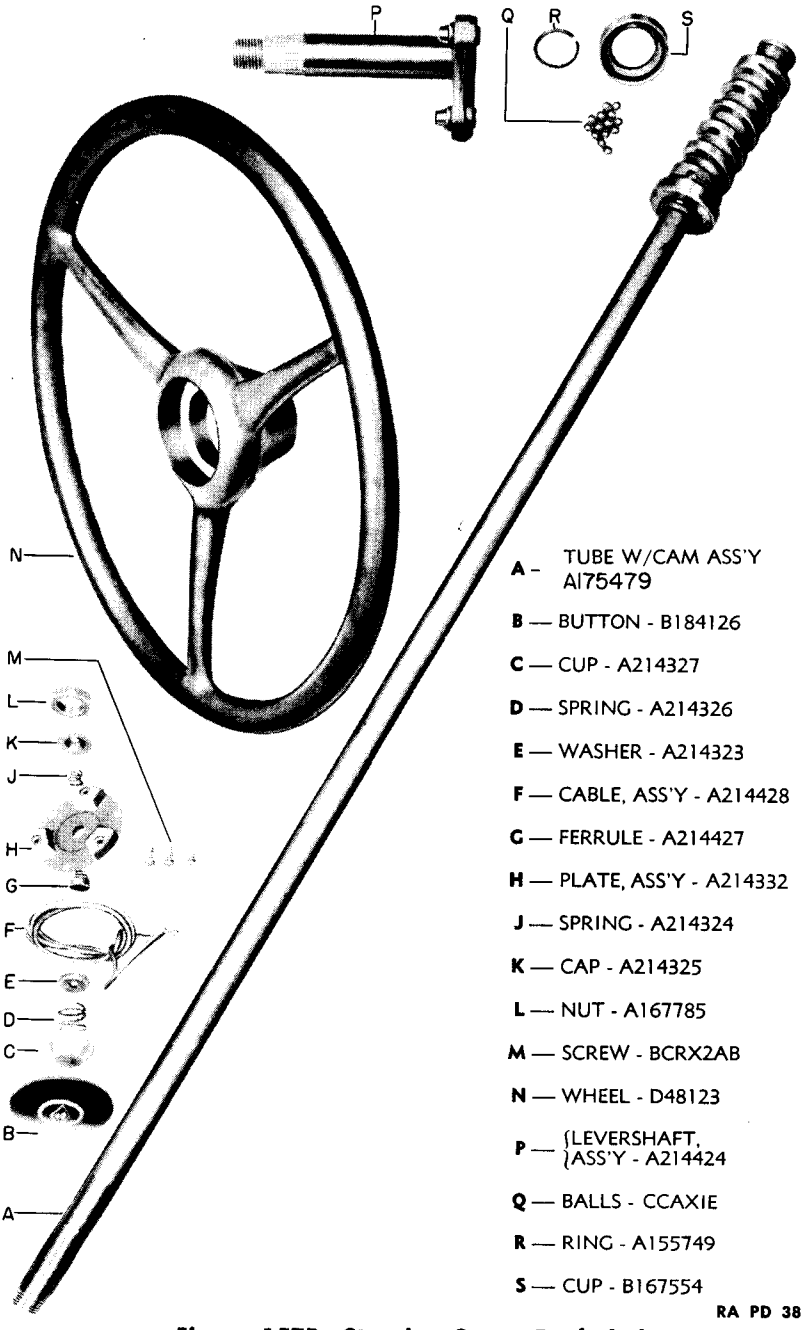


A — NUT - A155721
B — WASHER, LOCK - BECX2T
C — ARM, ASS'Y - A214425
D — {SCREW (BCBXICC)
WASHER, LOCK - BECX1K
E — {COVER - A175269
BOLT - BCBX1BG
NUT - BBBX1B
WASHER, LOCK - BECX1H
F — TUBE, ASS'Y - B184180
G — {HOUSING, ASS'Y - D48151
BUSHING (INNER) - A175266
BUSHING (OUTER) - A175267
PLUG - A175476
COVER, W/TUBE ASS'Y - A214429
H — PAD - B184113
J — CLAMP - A167616
K — {SHIM (.002) - A175261
(.003) - A175262
(.010) - A186512
L — COVER - B184179
M — {SCREW - BCAXIBD
WASHER, LOCK - BECX1H
N — GASKET - B167676
P — SCREW, SET - A175254
Q — SEAT - A175260
R — SPRING - A175258
S — BALL BEARING UNIT

RA PD 3814A

Figure 157A—Steering Gear—Exploded

STEERING GEAR AND DRAG LINK



A — TUBE W/CAM ASS'Y A175479

B — BUTTON - B184126

C — CUP - A214327

D — SPRING - A214326

E — WASHER - A214323

F — CABLE, ASS'Y - A214428

G — FERRULE - A214427

H — PLATE, ASS'Y - A214332

J — SPRING - A214324

K — CAP - A214325

L — NUT - A167785

M — SCREW - BCRX2AB

N — WHEEL - D48123

P — LEVERSHAFT, ASS'Y - A214424

Q — BALLS - CCAXIE

R — RING - A155749

S — CUP - B167554

RA PD 3814B

Figure 157B—Steering Gear—Exploded

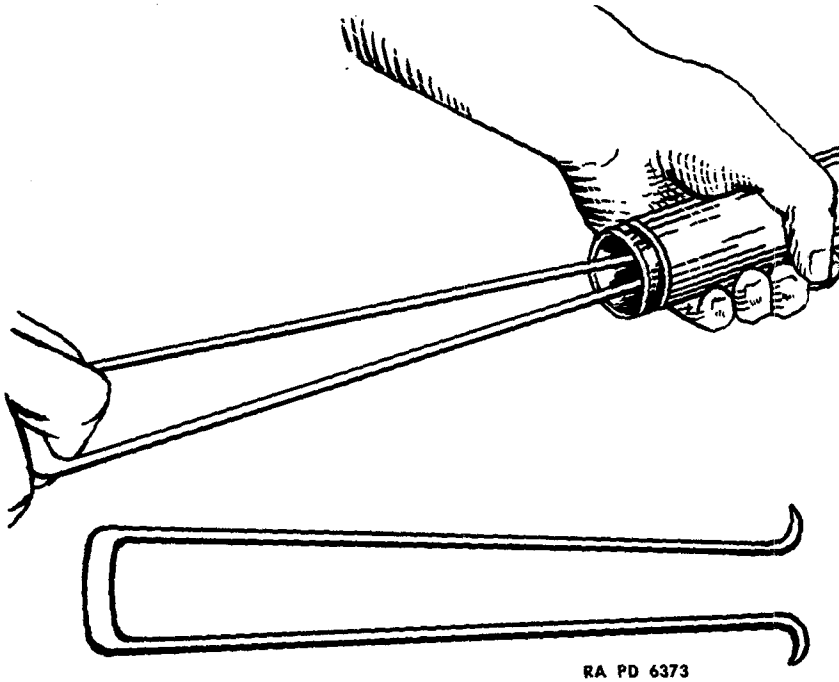


Figure 158—Steering Gear Jacket Tube Bearing Removal

(2) Check horn button and jacket tube springs for softness or breaks, and replace with new ones if necessary.

(3) Inspect bearing races and balls and steering arm ball for wear, chipping and scoring; repair or replace if apparent.

(4) Replace the housing bushings if scoring or excessive wear is visible, and install a new oil seal if the old one is damaged.

(5) Inspect the cam closely for wear or chipping, and replace tube and cam assembly if necessary.

(6) Check lever shaft studs for misalinement, bending, and wear, and if any is apparent, replace with new shaft assembly.

b. Drag Link Maintenance.

(1) After disassembly, clean all parts thoroughly in SOLVENT, dry-cleaning.

(2) Check ball seats for wear and scoring, and replace with new parts if necessary.

(3) If springs have become soft or broken, replace with new ones.

c. Steering Gear Adjustments. After the steering gear has been reassembled, the following adjustments can be made with the steering

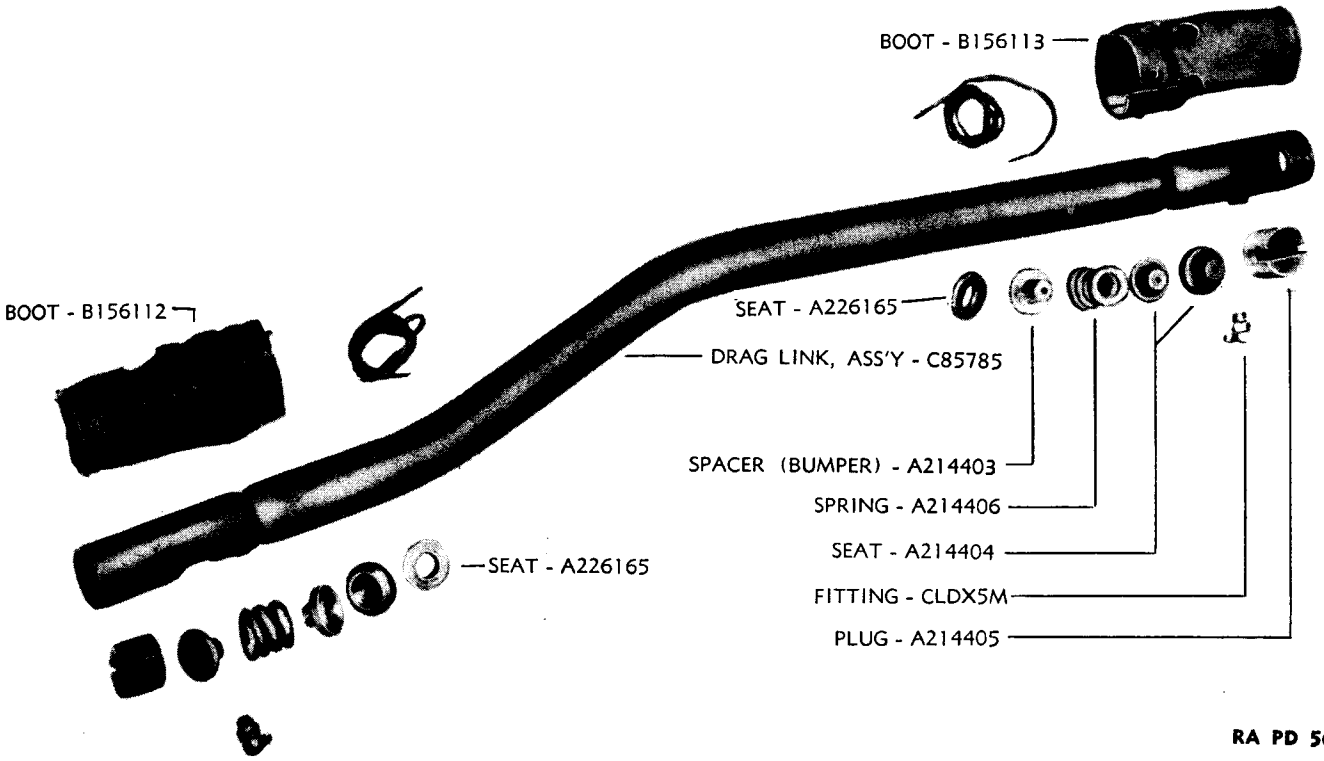


Figure 159—Drag Link—Exploded

gear either installed in the vehicle or dismounted. With the steering gear installed, it is necessary to first disconnect the drag link from the steering gear arm, and then loosen the instrument panel bracket holding the steering gear jacket tube. Follow the specific instructions exactly in the order given.

(1) CAM END PLAY (fig. 160). End play shows up as play in the steering wheel tube and cam ball bearings.

(a) Loosen the housing side cover screw and lock nut to free the studs in the cam groove.

(b) Remove the four upper cover screws, and raise the cover about ¼ inch to permit the removal of the adjusting shims. A combination of 0.002-, 0.003-, 0.010-, 0.030-inch shims are used between paper gaskets.

(c) Clip and remove one or more, 0.003-inch shim as required. Replace cover and tighten screws.

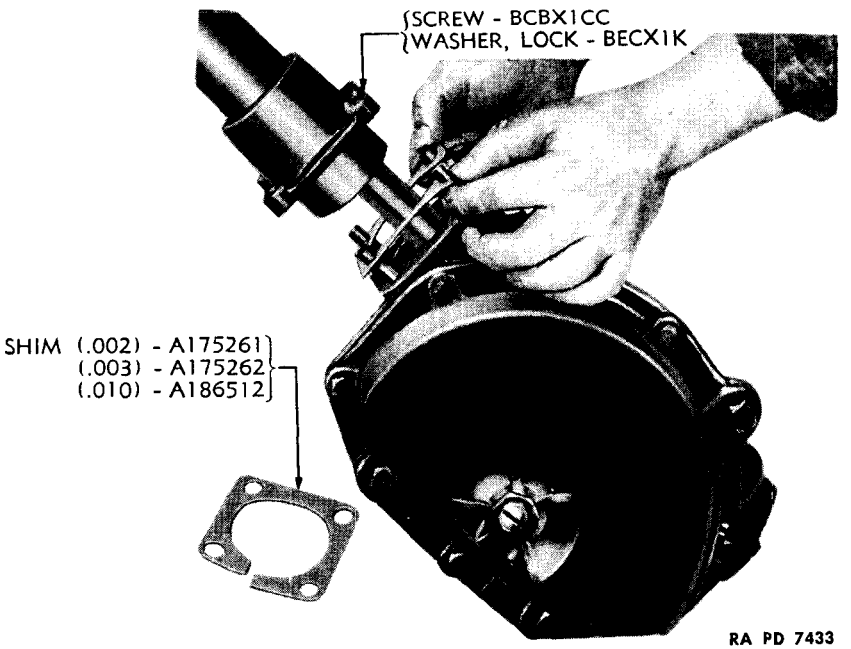
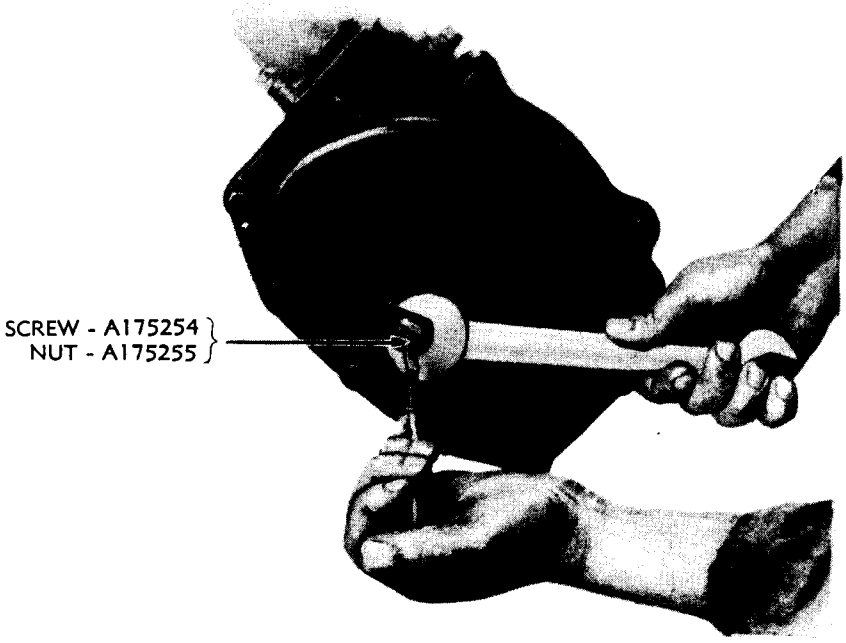


Figure 160—Steering Gear Cam End Play Adjustment

(d) Adjust side cover adjusting screw to a barely perceptible drag so that the steering wheel can be turned freely.

(e) Test adjustment, and if necessary, repeat operations to remove or replace more shims.

(2) LEVER SHAFT END PLAY (fig. 161). Backlash of the tapered studs in the cam groove shows up as end play of the lever shaft and as backlash at the steering wheel and the steering arm ball. Adjustment is made within the high range through the mid-position of the stud travel. The cam groove is purposely cut shallower, therefore narrower, in the mid-position range to provide close adjustment where the straight-ahead driving action takes place. It also makes this close adjustment possible after normal wear occurs without causing binding elsewhere. Therefore, adjust through this mid-position. Do not adjust in positions off mid-position as backlash at these points is normal and not objectionable.



RA PD 7432

Figure 161—Steering Gear Lever Shaft End Play Adjustment

(a) Tighten the side cover adjusting screw until a very slight drag is felt through the mid-position high range when turning the steering wheel slowly from one extreme to the other.

CAUTION: The gear must not bind at any place; only a very slight drag should be felt. A closer adjustment will not correct any steering

condition, but will damage and wear the steering gear parts and impair operation.

(b) When proper adjustment has been made, tighten the lock nut and give the steering gear the final test.

(c) Make sure that the steering ball arm is tight on the splined shaft and that the lock washer and nut are also tight.

(3) PRECAUTIONS. The foregoing cam and lever shaft end play adjustments are usually all that are required unless there are worn parts that need replacing; in this case it will be necessary to disassemble the steering gear and inspect. Always adjust the cam end play first. Do not attempt to cure wander, shimmy, or road shock by tightening the steering gear to remove these difficulties. Adjust the steering gear only to remove play in it.

(4) COLUMN ALINEMENT.

(a) Tighten the U bolt at the instrument panel steering column support.

(b) Turn the steering wheel to check whether stiffness or binding exists. If so, the adjustment is too tight or the steering column is out of alinement. The steering column must not be sprung in any direction.

(c) Check the steering gear frame bracket for tightness to the frame so that it holds the gear assembly rigidly and does not spring when the wheel is turned after the drag link is connected and the wheels are on the ground.

d. Drag Link Adjustments.

(1) The only adjustment possible on the drag link is the adjustment of the end plugs, and this is made after the link has been installed on the car.

(2) Using a drag link adjuster, tighten up the plugs just enough to prevent excessive looseness of the steering arm ball in the ball seats but not tight enough to cause binding. Back off enough to enable cotter pins to be inserted in the drag link tube and end plugs to secure the plugs in position.

e. Service Data.

Steering gear

Steering post bearings	No perceptible end play
Lever shaft thrust adjustment	Screw
Lever shaft end play	0.002 to 0.003 in.

Clearance between

Lever shaft and bushings

Outer	0.0005 in.
Inner	0.0025 in.

STEERING GEAR AND DRAG LINK

62. REASSEMBLY OF COMPONENTS.

a. Steering Gear (fig. 157). Before assembly, lubricate all parts thoroughly with wheel bearing grease.

Hammer
Hammer, soft metal
Screwdriver
Tool, bushing driving
Tube of smaller diameter than jacket tube
Wrench, open-end, ½-in.
Wrench, open-end, $\frac{9}{16}$-in.
Wrench, socket, ½-in.
Wrench, socket, $1\frac{7}{16}$-in.

(1) REPLACE BUSHINGS AND OIL SEAL.
Hammer
Tool, bushing driving
Drive bushings into housing, and then replace oil seal.

(2) REPLACE BEARINGS.
Screwdriver
Set balls onto inner race, replace outer race (cup), and lock in place with retaining ring.

(3) INSTALL CAM AND TUBE ASSEMBLY. Set cam into gear housing.

(4) REPLACE LEVER SHAFT AND STEERING ARM ASSEMBLIES.
Hammer, soft metal
Wrench, socket $1\frac{7}{16}$-in.
Insert lever shaft into housing until studs mesh with cam. Force steering arm onto lever shaft splines and if necessary tap with hammer. Replace lock washer and nut, and tighten assembly.

(5) REPLACE HOUSING SIDE COVER.
Wrench, socket, ½-in.
Place a new gasket between cover and housing, and tighten cover with cap screws and lock washers.

(6) REPLACE HOUSING UPPER COVER.
Wrench, open-end, $\frac{9}{16}$-in.
Set adjusting shims and cover on housing, and replace bolts and lock washers.

(7) REPLACE BEARING UNIT IN JACKET TUBE.
Tube of smaller diameter than jacket tube
Push bearing and seat into place and then replace spring.

(8) REPLACE JACKET TUBE.
Wrench, open-end, ½-in.
Wrench, socket, ½-in.
Seat tube in housing upper cover and tighten cover clamp bolt and nut.

(9) ADJUST STEERING GEAR. See paragraph 61 c, above.

b. Drag Link (fig. 159).
Adjuster, drag link or wide screwdriver

(1) REPLACE COMPONENTS IN AXLE END OF LINK.
Adjuster, drag link or wide screwdriver

In the order named, set bumper seat, spacer, spring, and bearing seats into axle attaching end of link, and turn up end plug enough to hold parts in place.

(2) REPLACE COMPONENTS IN STEERING GEAR END OF LINK.
Adjuster, drag link, or wide screwdriver

Set bearing seats, spring, spacer, and bumper seat, in order, into steering gear end of link, and replace end plug.

63. INSTALLATION OF ASSEMBLIES.

a. Steering Gear.

Pliers, spring pull-back
Screwdriver
Wrench, open-end, ¾-in.
Wrench, socket, $\frac{9}{16}$-in.
Wrench, socket, ⅞-in.
Wrench, socket, 1¼-in.

(1) ATTACH ASSEMBLY TO CAR.
Wrench, open-end, ¾-in.
Wrench, socket, ⅞-in.

Hold steering gear assembly in its running position, and bolt housing to frame bracket with bolt, lock washer, and nut. Replace frame bracket cap, and tighten it down with lock washers and cap stud nuts (fig. 156).

(2) REPLACE JACKET SUPPORTING U BOLT.
Wrench, socket, $\frac{9}{16}$-in.

Line up steering column at instrument panel support bracket, and replace U bolt lock washers and nuts (fig. 155). Tighten nuts.

(3) REPLACE STEERING WHEEL.
Wrench, socket, 1¼-in.

Force steering wheel onto steering tube, and fasten in place with wheel nut.

(4) REPLACE BASE PLATE AND HORN BUTTON ASSEMBLY.
Screwdriver

Set washer, spring, and base plate into wheel opening, and tighten down with three screws. Place cap, spring, cup, and horn button in place in the order given, and lock assembly by pushing down on button and rotating it one-sixth turn.

(5) CONNECT HORN BUTTON TO ELECTRICAL SYSTEM.
Pliers, spring pull-back

Reconnect horn button cable terminal at bottom of steering gear housing, and at the same time attach brake and clutch pull back springs to housing.

STEERING GEAR AND DRAG LINK

b. Drag Link (fig. 152).

Adjuster, drag link, or wide screwdriver	Wrench, open-end, $\frac{9}{16}$-in.
Screwdriver	Wrench, open-end, $\frac{3}{4}$-in.
	Wrench, socket, $\frac{9}{16}$-in.

(1) REPLACE LINK.

Adjuster, drag link, or wide screwdriver

Set steering gear in mid-position for straight-ahead driving by centering the arm at the mid-point of travel. Place wheels in straight-ahead driving position, and slip steering gear and axle steering arm balls into drag link openings. Tighten end plugs.

(2) ADJUST DRAG LINK.

Adjuster, drag link, or wide screwdriver

See paragraph 61 **d**, above.

(3) ADJUST STEERING GEAR.

Screwdriver	Wrench, open-end, $\frac{3}{4}$-in.
Wrench, open-end, $\frac{9}{16}$-in.	Wrench, socket, $\frac{9}{16}$-in.

Check steering gear, and if necessary, adjust assembly by following paragraph 61 **c**, above.

ORDNANCE MAINTENANCE—CHASSIS AND BODY FOR HALF-TRACK VEHICLES

Section XIV

CONSOLIDATED SERVICE DATA (FITS AND CLEARANCES)

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Wheel brake	66
Drive shaft brake	67
Radiator	68
Steering gear	69

64. MASTER CYLINDER.

Brake fluid	Wagner-Lockheed No. 21
Cylinder diameter	1½ in.
Piston clearance	0.001–0.004 in.
Piston return spring pressure at $2\frac{7}{64}$ in.	12 lb

65. VACUUM BOOSTER.

Piston return spring

Free length	13⅜ in.
Pressure at $6\frac{1}{16}$ in.	23 lb

($6\frac{1}{16}$ in. corresponds to inserted height at fullest extended position of cylinder)

66. WHEEL BRAKE.

Wheel cylinders

Piston clearance, front brake	0.001 in.–0.005 in.
Piston clearance, rear brake	0.001 in.–0.005 in.

Front and rear shoe adjustment

Cam (top of shoe)	0.010 in. at 1 in. from end
Eccentric (bottom of shoe)	0.005 in. at 1 in. from end

Brake return springs

Front cylinder piston:

Free length	2⅝ in.
Pounds pressure at 1¾ in.	1 to 1¼ lb

Rear cylinder piston

Free length	3⅛ in.
Pounds pressure at 2 in.	1½ to 2 lb

CONSOLIDATED SERVICE DATA (FITS AND CLEARANCES)

Shoe return springs
- Free length 7 3/16 in.
- Pounds pull at 8¼ in. 75 to 85 lb

Brake drum
- Regrinding limits 0.030 in.

67. DRIVE SHAFT BRAKE.

Brake adjustment
- Clearance, linings to disk 1/32 in.

Brake release spring
- Free length 4¾ in.
- Pounds pressure at 4 3/16 in. 60 lb

68. RADIATOR.

Stay rod studs (each side of radiator)
- Size ½–20 S.A.E. Threads (1 in. x 1¼ in.)

Bottom mounting studs
- Size ½–20 S.A.E. Threads (1 in. x 2⅞ in.)

69. STEERING GEAR.

Steering gear
- Steering post bearings No perceptible end play
- Lever shaft thrust adjustment Screw
- Lever shaft end play 0.002–0.003 in.

Clearance between
- Lever shaft and bushings
 - Outer 0.0005 in.
 - Inner 0.0025 in.

Section XV

PREPARATION OF UNITS FOR EXTREME TEMPERATURES OR UNUSUAL CONDITIONS

	Paragraph
Care in extreme temperatures	70
Care after fording streams or in flood conditions	71
Care after traversing deep muddy terrain	72
Care in sandy terrain and deserts	73

70. CARE IN EXTREME TEMPERATURES.

Temperatures ranging between −10 F and −30 F are designated as low, and temperatures below −30 F as extreme. OFSB 6-G-102 covers lubrication for temperatures to −10 F, and these same lubricants can be used if the temperature drops to −30 F for only short periods (overnight). In temperatures below −30 F any remaining heavy greases installed when the temperatures were above freezing must be replaced with lighter greases. Greases normally used cannot be applied at temperatures below 0 F except in heated buildings. In an emergency, when heated buildings are not available, use oil, and inspect and oil parts frequently. Additional information on cold weather lubrication may be found in OFSB 6-1 (formerly OFSB 6-Y-3).

a. Bogie Suspension and Track.

(1) In extreme temperatures it may be necessary to replace sealed ball and roller bearings with bearings which have been packed with special low temperature lubricants. (See OFSB 6-2, Product Guide (formerly OFSB 6-4), for low temperature lubricants.)

(2) Rubber tracks and tires should be brought to rest on brush, weeds, boards, or other material to prevent them from freezing to the ground and being damaged when they are started again.

(3) Grousers should be attached to the tracks when traveling over snow or icy terrain.

(4) In extreme temperatures, inspect bogie parts frequently for breaks, since at these temperatures the shock resistance of metals is greatly reduced.

b. Brake System. After driving in sleet or deep snow in temperatures below freezing, test the vehicle brakes before starting to make certain that the linings are not frozen to the drums. If this has occurred, free the

brakes by pouring boiling water over the drums just before operation. Drive the vehicle with the brakes lightly applied until the brakes thaw out, taking precautions to prevent burning of the brake linings.

c. Cooling System. The cooling system should be filled with an antifreeze solution employing either ethylene glycol or equivalent, or approved alcohol. The system should be cleaned thoroughly and tightened before any antifreeze is added (see par. 84, TM 9-710). The following table gives the correct amount of antifreeze necessary for various temperature conditions, but an antifreeze solution hydrometer should be used as a check:

ANTIFREEZE CHART

Temperature	Denatured alcohol	Ethylene glycol (Prestone)
+20 F	5¼ qt	4¼ qt
+10 F	7¾ qt	6½ qt
0 F	10¼ qt	8¾ qt
−10 F	11¾ qt	10¼ qt
−20 F	13 qt	11½ qt
−30 F	16¼ qt	12½ qt

To prevent excessive cooling of the engine and poor combustion during cold weather the radiator shutters should be partially closed or the radiator core partly covered in some manner.

d. Battery.

(1) The freezing point of battery electrolyte depends upon its specific gravity. There is little danger of freezing except with a discharged battery. In order to avoid freezing of the electrolyte, the battery should always be kept in a fully charged condition. The following table shows the freezing points of electrolyte:

FREEZING POINTS OF ELECTROLYTE

Specific gravity	Freezing temperature
1.120	+14 F
1.150	+6 F
1.200	−17 F
1.225	−35 F
1.250	−62 F
1.275	−85 F

(2) In freezing weather, when necessary to add water to the battery, always do it just before running the engine. If the temperature is ex-

tremely low, start the engine so that the battery is charging before adding water. The reason for this is that water, being lighter than electrolyte, will remain on the surface and freeze unless it is thoroughly mixed with the electrolyte.

c. Fuel System.

(1) In extreme temperatures, insulating the fuel lines will help prevent ice from forming inside the lines.

(2) Small quantities of denatured alcohol, about ½ pint to a tank of fuel, will reduce difficulties from water in gasoline.

(3) Any arrangement for directing the heat from the exhaust manifold back over the fuel lines and tanks is beneficial.

71. CARE AFTER FORDING STREAMS OR IN FLOOD CONDITIONS.

After fording shallow streams, it is not usually necessary to take any preventive maintenance steps. However, if the units have been submerged for several hours or more, because of fording deep streams or being in a flooded area, it is necessary to remove all foreign matter which may have accumulated. This is done by thoroughly dismantling the units submerged, washing each part in SOLVENT, dry-cleaning, and then spreading a thin film of oil over the parts. In instances when emergency requirements make an immediate, complete cleansing impossible, some damage may be prevented and the vehicle kept in service by the following procedure:

a. Bogie Suspension. Remove bogie roller bearings, and clean and repack completely with recommended lubricant and reassemble. Always replace grease retainers at roller hubs with new ones, since old, gritty retainers, if replaced, may damage or cut away the seat and cause leakage.

b. Brake System.

(1) Remove the brake drums, and wipe the linings and anchor pins clean. Lubricate the pins.

(2) Drain the brake lines, flush the system with alcohol, and refill with new brake fluid.

c. Cooling System. If any grit or dirty water has seeped into the cooling system, drain out the liquid. Then flush the system thoroughly and refill with clean liquid. Clean the outside of the radiator case.

d. Electric Lighting System, Battery, and Accessories. Wipe all wires and contact points clean and dry. Clean the battery terminals and

check the battery for signs of discharging because of short-circuiting by the water or other foreign matter. Recharge battery, if necessary.

e. Fuel System. If any part of the fuel system has been submerged, drain and flush the system thoroughly, and refill with gasoline using ½ pint of alcohol to each tank full of fuel to counteract the effect of the water. If any grit gets into the carburetor, it may be necessary to remove the carburetor and clean the jets and needle valve.

f. General. Lubricate the steering gear and all pedals, shafts, and linkages beneath the hood and on the chassis.

NOTE: At the first opportune time, completely disassemble each unit and clean thoroughly.

72. CARE AFTER TRAVERSING DEEP MUDDY TERRAIN.

After operating in mud or water, the vehicle should be cleaned and lubricated thoroughly. All lubrication fittings should be free of dirt and grit before lubricating. Further information is not now available, but will be published at a later date.

73. CARE IN SANDY TERRAIN AND DESERTS.

Vehicles should be cleaned and lubricated more frequently when operating in extremely hot climate or on sandy terrain. Frequent lubrication tends to keep grit and abrasive substances out of moving parts. Further information is not now available but will be furnished at a later date.

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Section XVI

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74. STANDARD NOMENCLATURE LISTS.

a. Cleaning, preserving and lubricating materials	SNL K-1
b. Car, half-track, M2; carrier, personnel, half-track, M3; carrier, 81mm mortar, half-track, M4	SNL G-102
Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index"	OPSI

75. EXPLANATORY PUBLICATIONS.

a. Cleaning, preserving, lubricating and welding materials	TM 9-850
b. Half-track materiel.	
Ordnance lubrication program—general	OFSB 6-11
Half-track vehicles: half-track car M2; half-track personnel carrier M3	TM 9-710
Motor transport	FM 25-10
Power train for half-track vehicles	TM 9-1710
Ordnance Maintenance; White, 160AX engine, half-track vehicles	TM 9-1711
81mm mortar, M1	FM 23-90
c. Lubrication.	
Automotive lubrication	TM 10-540
Detailed lubrication instructions for ordnance materiel	OFSB 6 series
Lubrication instructions for cars, half-track	OFSB 6-G-102
d. Maintenance and repair.	
Armor plate; repair by welding	TM 9-1852
Echelon system of maintenance	TM 10-525
Hand, measuring, and power tools	TM 10-590
Maintenance and care of pneumatic tires	TM 31-200
Maintenance and repair	TM 10-520

REFERENCES

Sheet metal work, body, fender and radiator repairs	TM 10-450
e. Military Motor Vehicle and Components.	
Military motor transportation	TM 10-505
Military motor vehicles	AR 850-15
Motor transport inspections	TM 10-545
The motor vehicle	TM 10-510
f. Storage and Shipment.	
Loading of mechanized and motorized equipment on open top railroad equipment—Association of American Railroads Storage of motor vehicle equipment	AR 850-18
g. Miscellaneous.	
Automotive power transmission units	TM 10-585
Electrical fundamentals	TM 1-455
Fire prevention, safety precautions, accidents	TM 10-360
Fuels and carburetion	TM 10-550
List of publications for training	FM 21-6
Motor transport circular 1-10	QMC
Motor transport technical service bulletins	QMC

76. TRAINING FILMS AND FILM STRIPS.

a. The story of automotive lubrication	TF 25-76
b. Maintenance and Repairs.	
The motor vehicle driver, first echelon maintenance	TF 11-558
Third echelon maintenance	FS 10-55
Fourth echelon maintenance	FS 10-56
The motor vehicle driver, loading, trouble shooting, reports and vehicle abuse	TF 11-559
Sheet metal work, body, fender, and radiator repairs	FS 10-59
c. Engine and Components.	
Automotive brakes	FS 10-36
Automotive power transmission units	FS 10-34
Gasoline motors	TF 10-166
Ignition and a spark plug	TF 25-152
Internal combustion engines	FS 1-15
The internal combustion engine	FS 10-42
Storage battery	FS 10-61
d. Automotive Electricity.	FS 10-33

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